

# TM 5-3068

WAR DEPARTMENT TECHNICAL MANUAL

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TRACTOR, CRAWLER

DIESEL, 70-to 90-DBHP

STANDARD

CATERPILLAR

MODEL D7

74-IN. GAGE

(Tractor Serial Numbers 7M1 and up, 3T1 and up, and 4T1 and up)

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WAR DEPARTMENT • MARCH 1945



This Technical Manual supersedes the Operation and Maintenance Instructions of TM 5-3068 authenticated 1 June 1943. TM 5-3068A, when published, will supersede the Repair Instructions of TM 5-3068 authenticated 1 June 1943. ENG 9-3068, when published, will supersede the Parts Section of TM 5-3068 authenticated 1 June 1943.

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**OPERATION AND MAINTENANCE INSTRUCTIONS**

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WAR DEPARTMENT 19 MARCH 1945

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## WAR DEPARTMENT

Washington 25, D. C., (19 March 1945)

TM 5-3068, Tractor, Crawler, Diesel, 70 to 90-DBHP, Standard, Caterpillar, Model D7, 74-in Gage, (Tractor Serial Numbers 7M1 and up, 3T1 and up and 4T1 and up) is published for the information and guidance of all concerned.

A. G. 300.7 (22 Dec 44)

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*Chief of Staff*

Official:

J. A. ULIO,  
*Major General,  
The Adjutant General.*

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Refer to FM 21-6 for explanation of distribution formula.



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## PART ONE INTRODUCTION

### SECTION I GENERAL

#### 1. SCOPE.

a. These instructions are published for the information and guidance of the personnel to whom this equipment is assigned. They contain information on the operation and maintenance of the equipment as well as descriptions of the major units and their functions in relation to the other components of the equipment. They apply only to the Caterpillar D7 Tractor and are arranged in four parts: Part one — Introduction; Part two — Operating Instructions; Part three — Maintenance Instructions; Part four — Auxiliary Equipment. Part five — Repair information is contained in a separate Technical Manual, TM5-3068A. Parts information is contained in Supply Catalog ENG9-3068.

b. Supply Catalogs, Standard Nomenclature Lists, Technical Manuals and other publications applicable to the material covered by this manual are listed in Section XXX at the end of the book.

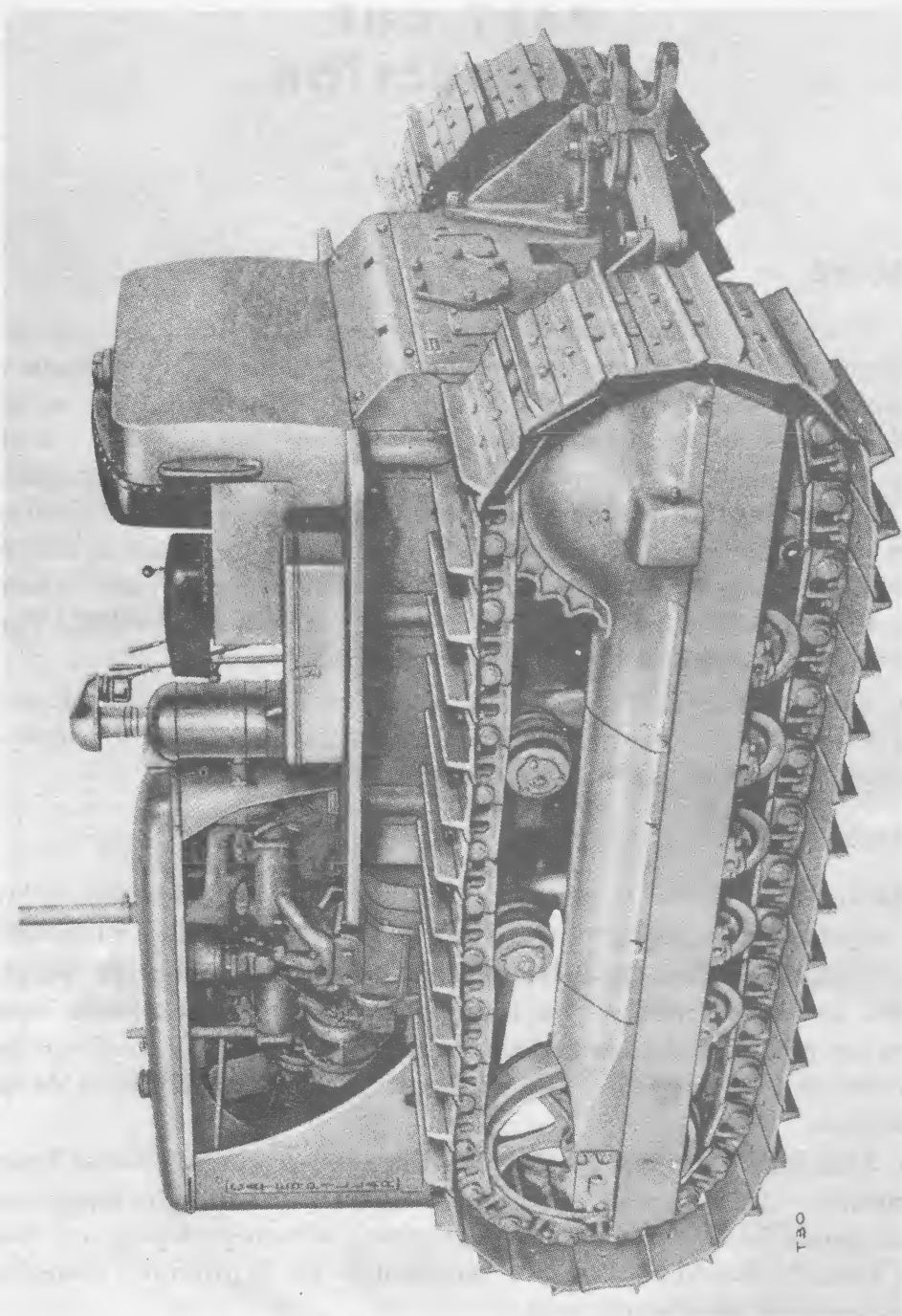
#### 2. RECORDS.

Maintenance record forms listed and briefly described in the following subparagraphs shall be used in the maintenance of this equipment.

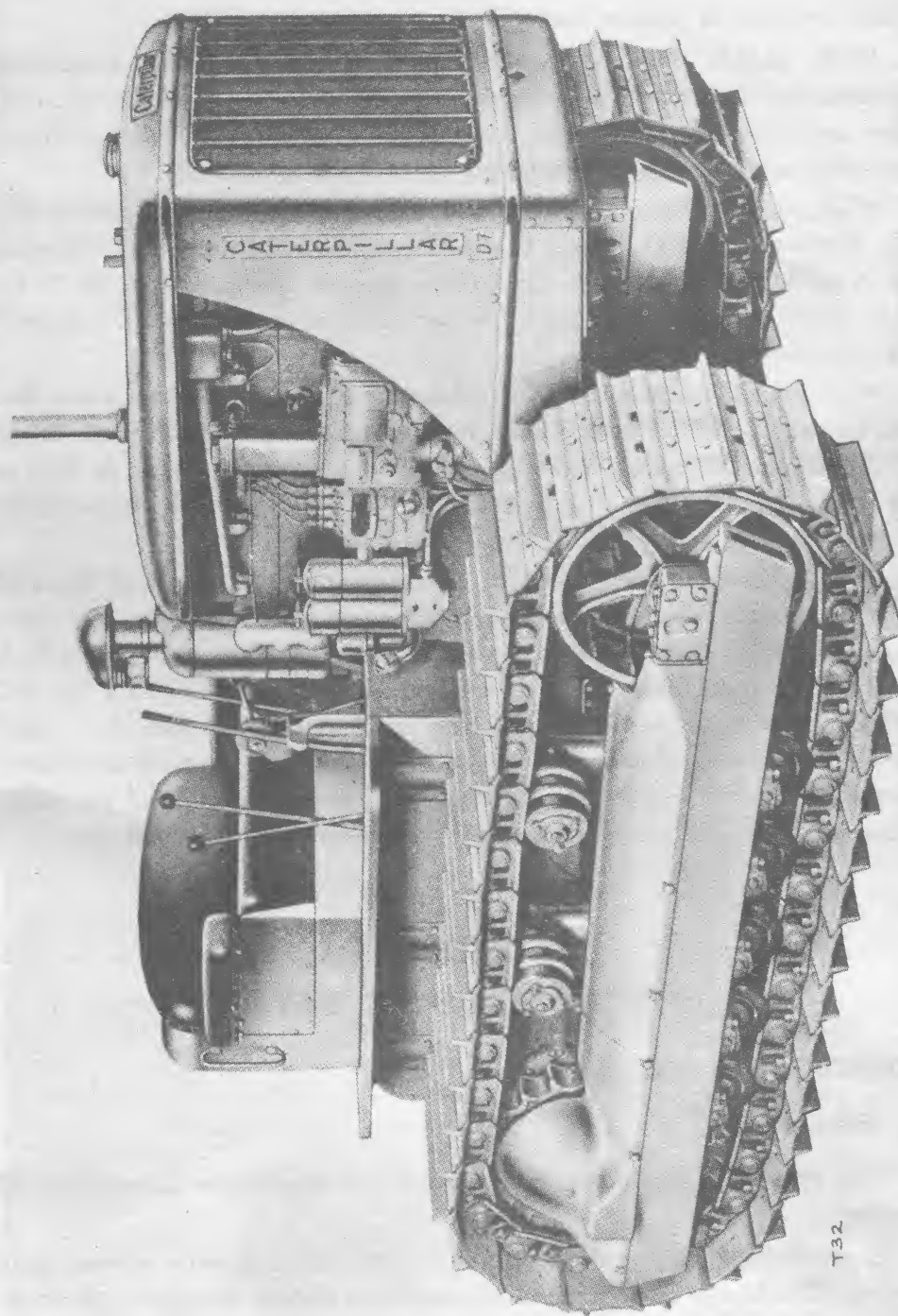
a. **W.D., Form No. 48, Driver's Trip Ticket And Preventive Maintenance Service Record.**—This form shall be used by equipment operators for reporting the accomplishment of daily preventive maintenance services, and for reporting any equipment deficiencies observed during operation.

b. **Standard Form No. 26, Driver's Report—Accident, Motor Transportation.**—One copy of this form shall be kept with the equipment at all times. In case of an accident resulting in injury or property damage, Form 26 should be filled out immediately (or as promptly thereafter as is practical) by the operator.

c. **W.D., A.G.O. Form No. 464, Preventive Maintenance Services And Technical Inspection Work Sheet For Engineer Equipment.**—This form is used by personnel of the using organization and higher echelons for reporting the results of preventive maintenance services and technical inspections.



**Figure 1—Caterpillar D7 Tractor Left Rear View**



**Figure 2—Caterpillar D7 Tractor Right Front View**

T32

d. **W.D., A.G.O. Form 460, Preventive Maintenance Roster.**—This form shall be used for maintaining an operating time record of the item of equipment, and for the scheduling of lubrication and preventive maintenance services at proper intervals.

e. **W.D., A.G.O. Form No. 478, MWO And Major Unit Assembly Replacement Record.**—Major repairs or rebuilding, the replacement of major unit assemblies, and the accomplishment of equipment modifications shall be recorded on this form.

f. **W.D., A.G.O. Form No. 9-68 (Supersedes W.D., A.G.O., Form No. 9-70, Formerly 7353), Spot Check Inspection Report For Wheeled And Half-Track Vehicles.**—This form may be used in lieu of W.D., A.G.O. Form No. 464 as a check list for applicable items to be inspected during spot-check inspection.

g. **W.D., A.G.O. Form No. 9-69 (Supersedes W.D., A.G.O. Form No. 9-70, Formerly 7353), Spot Check Inspection Report For All Full-Track And Tank-Like Wheeled Vehicles.**—This form may be used in lieu of W.D., A.G.O. Form No. 464 as a check list for applicable items to be inspected during spot-check inspection.

h. **W.D., A.G.O. Form No. 468, Unsatisfactory Equipment Record.**—This form shall be used in reporting manufacturing, design, or operational defects in material, with a view to correcting such defects; it shall be used also in recommending modifications of material. Form No. 468 shall not be used for reporting failures, isolated material defects, or malfunctions of material resulting from fair wear and tear or accidental damage. Form No. 468 shall not be used to report the issue of parts and equipment; nor for the reporting of replacements and/or repairs.

## SECTION II

### DESCRIPTION AND DATA

#### 3. DESCRIPTION. (See figure 3.)

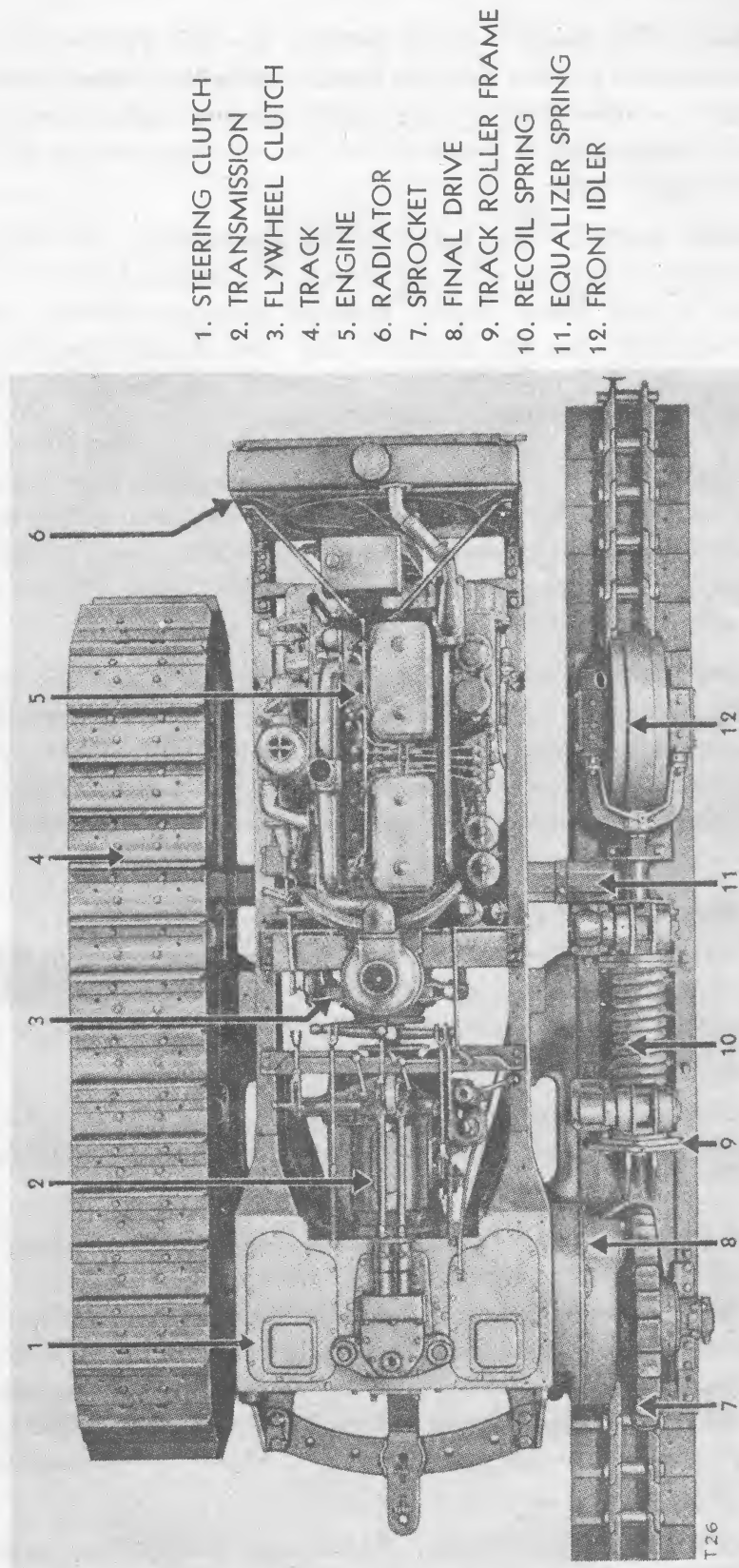
##### a. General.

(1) The tractor described in this manual is a track-type Caterpillar D7 Tractor.

(2) A track-type tractor differs from a wheel-type tractor in two main respects. Tracks are used instead of wheels to obtain traction, and steering is accomplished by disengaging the power from one track or the other by means of steering clutches.

(3) Tracks distribute weight and traction over a large area and permit the tractor to operate over a wide variety and condition of terrain. This feature makes a track type tractor particularly adaptable to earthmoving.





1. STEERING CLUTCH
2. TRANSMISSION
3. FLYWHEEL CLUTCH
4. TRACK
5. ENGINE
6. RADIATOR
7. SPROCKET
8. FINAL DRIVE
9. TRACK ROLLER FRAME
10. RECOIL SPRING
11. EQUALIZER SPRING
12. FRONT IDLER

Figure 3—D7 Tractor Nomenclature



b. **Engine.**—The engine which powers the D7 Tractor is a four-cylinder, four-stroke cycle, valve in head, Caterpillar Diesel engine. The Diesel engine is quite similar to the spark-ignition engine except that in the Diesel engine, fuel is injected into the cylinders and is ignited by the heat of compression.

c. **Starting Engine.**—An independent two-cylinder, 24 horsepower gasoline engine is used to start the Diesel. The starting engine power is transmitted to the Diesel engine flywheel through a pinion which is manually engaged with the flywheel ring gear. It will spin the Diesel with compression on, for as long as necessary and the pinion automatically releases when the Diesel engine starts.

d. **Flywheel Clutch.**—The flywheel clutch is a plate, over center, type clutch. It is engaged by pulling back on a lever and will remain engaged until the lever is pushed forward again. The clutch driving plate is attached to the engine flywheel with flexible links. The driven and pressure plates are attached to the transmission upper shaft.

e. **Transmission.**—The transmission gear shift levers enable the operator to select any one of five forward or four reverse speeds. An interlock mechanism, operated by the flywheel clutch control lever, prevents the gears from being shifted while the clutch is engaged. Power is transmitted through gears from the upper shaft to the pinion shaft which drives the bevel gear.

f. **Steering Clutches and Brakes.**

(1) The steering clutches are dry, multiple disc clutches, held in engagement by springs. The steering clutches are attached to the ends of the bevel gear shaft. The outer drums are mounted on the final drive pinions. The brake bands operate on the outer drums.

(2) Steering is accomplished by disengaging either clutch and applying the brake which stops one track and allows full power to go to the other track.

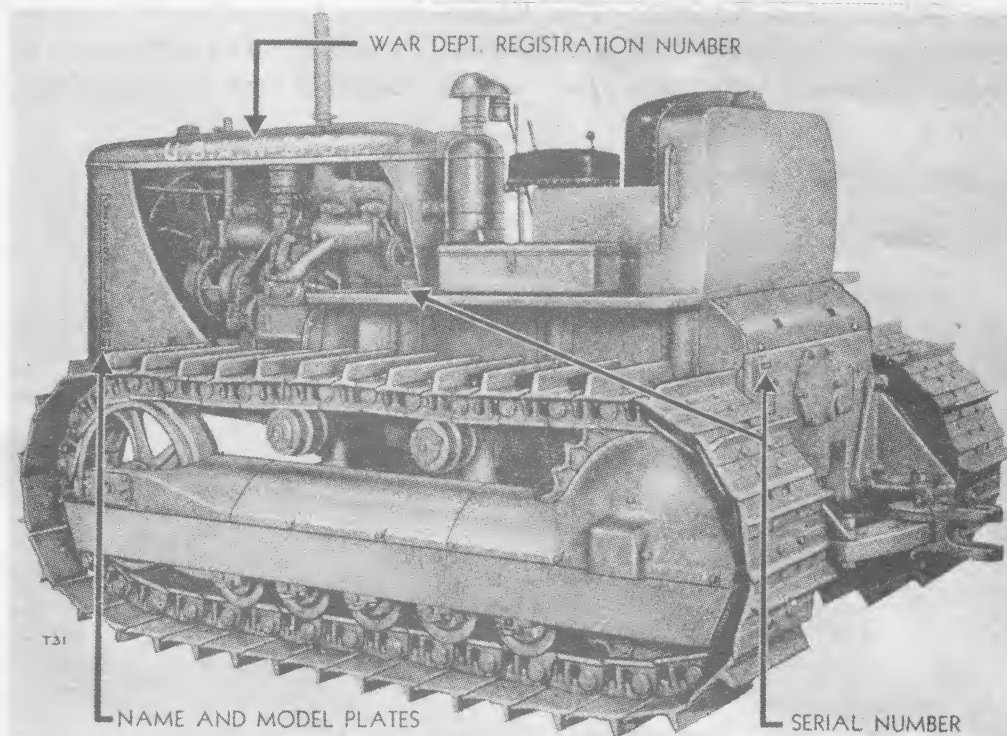
g. **Final Drive Group.**—The final drive housings are bolted to the sides of the transmission and steering clutch case. The power is transmitted from the steering clutches, through the final drive pinion and double reduction gears, to the sprocket which is mounted on the final drive gear hub. Bellows type, self-aligning seals on each side of the sprocket, seal the final drive gear case. The sprocket shaft, pressed into the transmission case, extends through the final drive gear hub and supports the outer bearing.

h. **Track Roller Frame Group.**—The tractor is supported on the track roller frame assemblies at the front by the equalizer spring and at the rear by the sprocket shafts. This construction allows the track roller

Description and Data

frames to move up and down independently when the tractor is operated over rough ground. The track rollers, which are mounted on the track roller frames, support the entire weight of the tractor on the tracks.

i. **Track.**—The final drive sprocket engages the track which forms an endless chain around the sprocket and front idler. The idler guides the track into position in front of the track rollers. It is connected to the recoil spring by the track adjusting screw which determines the position of the idler on the track roller frame. The recoil spring bolt holds the recoil spring in compression which prevents the spring from ever pushing the idler ahead of the position determined by the adjusting screw and at the same time allows the recoil spring to form a cushion for the idler, letting it move back if a foreign object should get between the track and rollers or if the track should run into a solid object.



**Figure 4—Identification Plates and Numbers**

**4. IDENTIFICATION PLATES.** (See figure 4.)

a. **General.**—When parts requisitions and regular reports are made up it is important that the tractor name, model number, War Department registration number and serial number of the tractor involved be placed on the forms.

b. **Name Plate.**—The manufacturer's name; CATERPILLAR and model designation D7 are stamped on plates attached to the radiator guard.

c. **War Department Registration Number.**—The War Department Registration number is painted on the hood with blue drab lusterless enamel and the original marking is applied by the manufacturer. The registration number assigned to a tractor establishes its permanent identity and under no circumstances will this number, when once assigned, be changed or transferred to another vehicle without the authority of the procuring agency. The digit *nine* after the letter W indicates the vehicle type, namely tractors, track laying (light, medium and heavy). The remaining digits indicate the numerical sequence in which the tractor has been added to the type group.

d. **Serial Number.**—The tractor serial number is stamped on two metal plates. One plate is located on the back face of the steering clutch case and the other plate is located on the side of the engine block.

e. **Difference in Models.**—This manual covers Caterpillar D7 tractors bearing serial numbers 7M1 and up and 4T1 and up. The differences in design of tractors within this group will be identified with serial numbers.

## 5. TABULATED DATA.

### a. Dimensions and Weights.

#### Diesel D7 Tractor without Auxiliary Equipment or Attachments

Weight .....	23,675 lb.
Height, excluding exhaust and pre-cleaner.....	6 ft. 8 in.
Length .....	13 ft. 6 $\frac{1}{4}$ in.
Width .....	8 ft. 2 in.
Ground Clearance .....	15 $\frac{1}{2}$ in.

#### Auxiliary Equipment Weights (Approximate)

Equipment	Weight
Angledozer, LeTourneau WCK7.....	5,390 lb.
Power Control Unit, LeTourneau FTD7.....	700 lb.
Power Control Unit, LeTourneau R7—with neck.....	1,525 lb.
Towing Winch, Willamette-Hyster D7N.....	2,450 lb.
Trailbuilder, LaPlant Choate R71.....	7,150 lb.
Trailbuilder, LaPlant Choate R76F.....	6,100 lb.

### b. Performance.

Horse Power, Drawbar.....	80.44
Horse Power, Belt.....	92.84

#### Speed and Drawbar Pull with Standard Transmission

Speed	Forward	Reverse	Drawbar Pull
First	1.4 mph	1.6 mph	21,351 lb.
Second	2.2 mph	2.6 mph	13,454 lb.
Third	3.2 mph	3.8 mph	9,090 lb.
Fourth	4.6 mph	5.4 mph	5,994 lb.
Fifth	6.0 mph		4,550 lb.

### c. Diesel Engine.

Model—4-Stroke cycle, water cooled  
Number of Cylinders—4  
Bore and Stroke—5 $\frac{3}{4}$  in. x 8 in.  
Firing Order—1-3-4-2  
Weight—4,400 lb.

Tools, Parts and Accessories

**d. Starting Engine.**

Model—4-Stroke cycle, water cooled, spark ignition  
Number of Cylinders—2  
Bore and Stroke—3 $\frac{5}{8}$  in. x 4 in.  
Brake Horsepower—24 hp @ 2700 rpm.

**e. Capacities (Approximate).**

	U. S. Measures
Air Cleaner, Diesel Engine.....	3 $\frac{1}{4}$ qt.
Air Cleaner, Starting Engine.....	$\frac{1}{2}$ qt.
Cooling System .....	18 gal.
Crankcase, Diesel Engine.....	22 qt.
Crankcase, Starting Engine.....	2 $\frac{1}{4}$ qt.
Final Drives (each).....	24 qt.
Fuel Injection Pump Housing.....	1 qt.
Fuel Tank, Diesel Engine.....	65 gal.
Fuel Tank, Starting Engine.....	2 gal.
Hydraulic Steering Clutch Control Housing.....	5 qt.
Transmission, Starting Engine.....	1 $\frac{1}{3}$ qt.
Transmission, Tractor .....	40 qt.

**f. Accessories.**

	Size	Model	Make
*Battery, lighting and starting system .....	6 Volt	SW-2-116	Willard
*Generator, charging .....	6 Volt, 90 Watt	1101667	Delco Remy
*Generator, charging .....	6 Volt, 175 Watt	977-R	Delco Remy
*Generator, lighting .....	6 Volt, 130 Watt	ARKF	Bosch
*Generator, lighting .....	6 Volt, 130 Watt	GFY4801	Auto-Lite
*Lamp bulb, head.....	6-8 Volt, 32-21 cp.	2320 SAE	Mazda
*Lamp bulb, dash and tail.....	6-8 Volt, 3 cp.	Single contact	Mazda
Magneto, starting engine.....		RC-2Q	Eiseman
Spark plug, starting engine.....	18mm.	15A	Champion
*Starter, starting engine.....	6 Volt	1107029	Delco Remy
Carburetor, starting engine.....		Series 22	Zenith
Fuel injection system.....		D7	Caterpillar
Air cleaner, Diesel oil bath.....		A1025	Donaldson
Air cleaner, starting engine.....		B654	Donaldson

*\*Special Attachments*

**SECTION III**

**TOOLS, PARTS AND ACCESSORIES**  
(Supplied with Tractor)

**6. TOOL LIST.**

The list accompanying figure 5 contains the tools which accompany each tractor. (See figure 5.)

**7. PARTS LIST.**

The list accompanying figure 6 contains the spare parts which accompany each tractor. (See figure 6.)

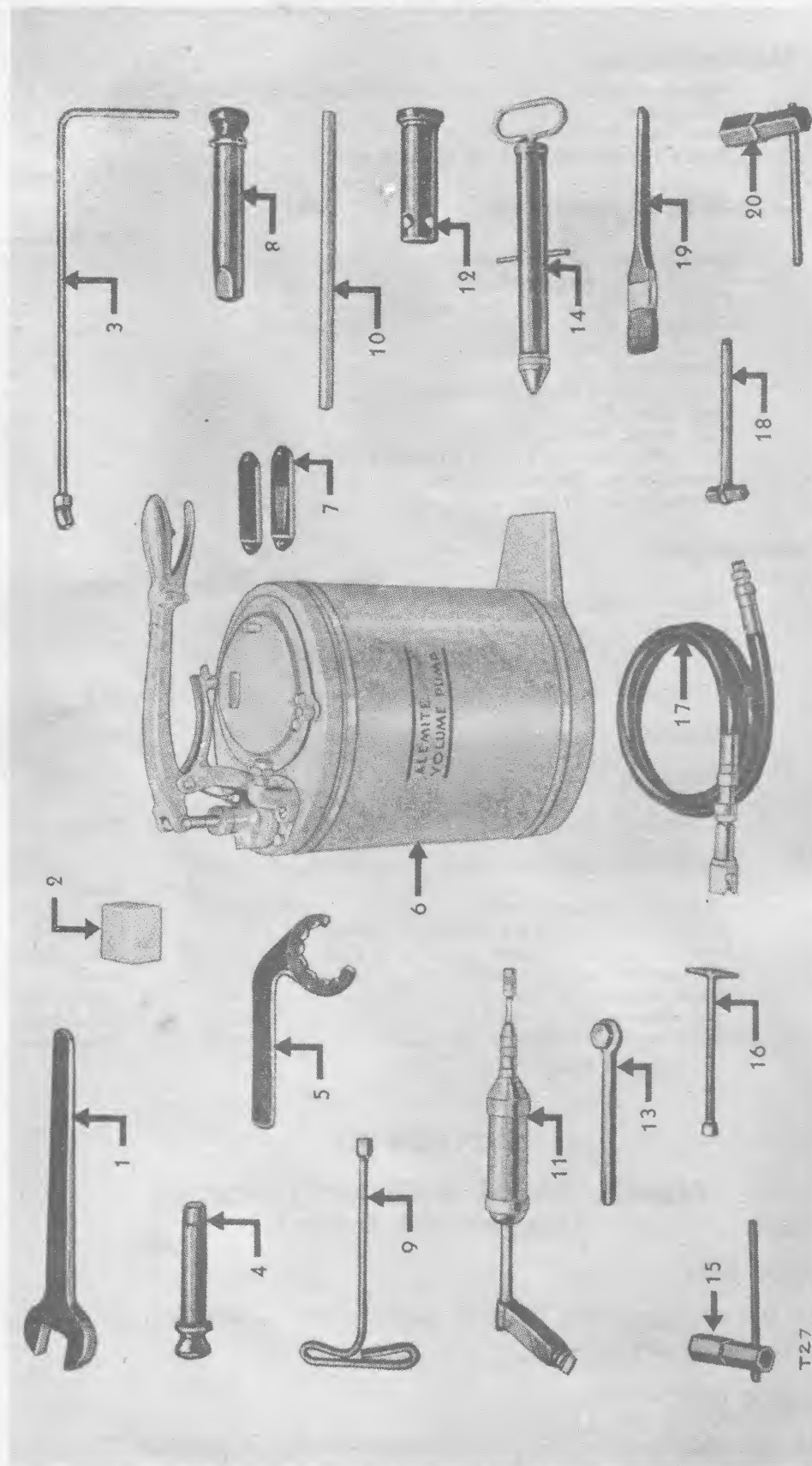


Figure 5—(sheet 1 of 2 sheets)—Tools and Supplies, Supplied with Tractor



Reference No.	Description	Quantity	Part No.
1	Wrench (Track Adjusting).....	1	2F5131
2	Box Containing Items 24-29.....	1	2B520
3	Wrench (Flywheel Clutch Adjusting)...	1	1B6109
4	Pin (Drawbar Swing Lock).....	1	7B884
5	Wrench (Water Pump Packing Nut)...	1	4A334
6	Volume Compressor .....	1	4B1856
7	Heel Plates .....	2	SI659
8	Pin (Drawbar) .....	1	7B889
9	Wrench ( $\frac{9}{16}$ in. Hex.) .....	1	L2303
10	Handle (Injection Valve Wrench).....	1	4B9918
11	Compressor (Hydraulic fitting).....	1	3B8580
12	Wrench (Injection Valve) .....	1	7B4973
13	Wrench ( $1\frac{3}{16}$ in. Hex. Drain Plug)....	1	3B8829
14	Grease Gun .....	1	3B2301
15	Wrench (Spark Plug).....	1	3B1285
16	Wrench (Fuel Pump Vent Screw).....	1	4A62
17	Hose (part of 4B1856 Compressor)....	1	1F221
18	Wrench (Final Drive Drain).....	1	1B5175
19	Brush (For Cleaning).....	1	2B4317
20	Wrench (Oil Filter Drain) .....	1	3563A
21	Bolt .....	4	SI581
22	Lockwasher .....	4	3B4506
23	Nuts .....	4	1B4203
24	Stopper (Injection Pump) .....	4	2A4905
25	Plug (Overflow Line).....	1	1F1559
26	Seal (Injection Valve).....	4	1A7776
27	Cap (Injection Valve and Pump).....	8	1A8634
28	Plug (Injection Lines).....	8	2A913
29	Cap (Injection Pump Housing).....	4	2A4716

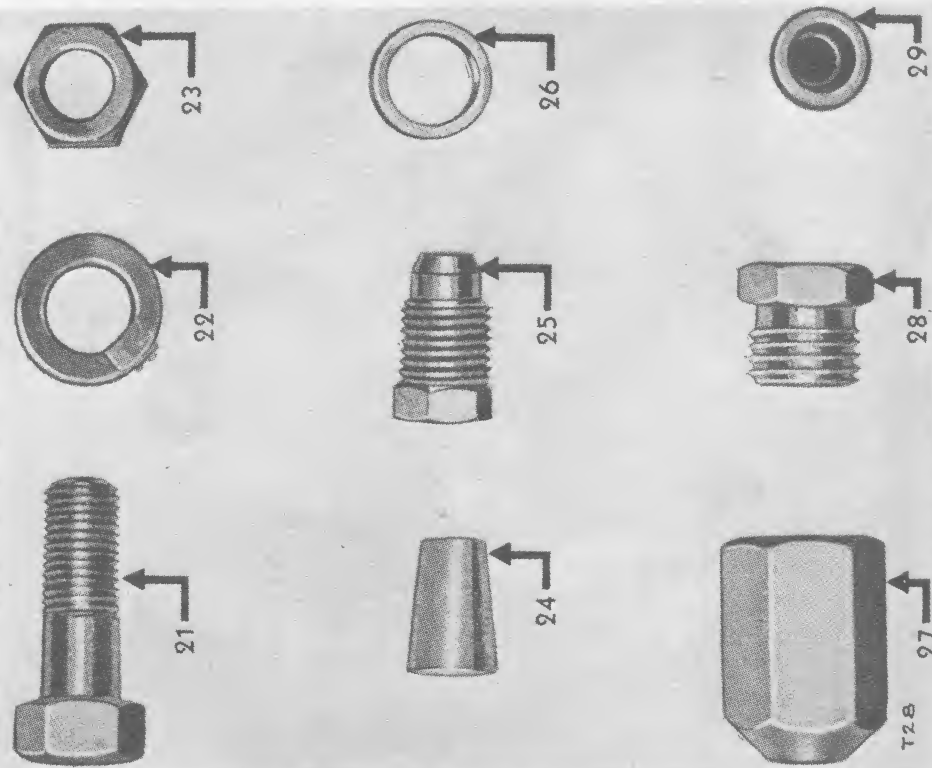


Figure 5—(sheet 2 of 2 sheets)  
Tools and Supplies, Supplied with Tractor

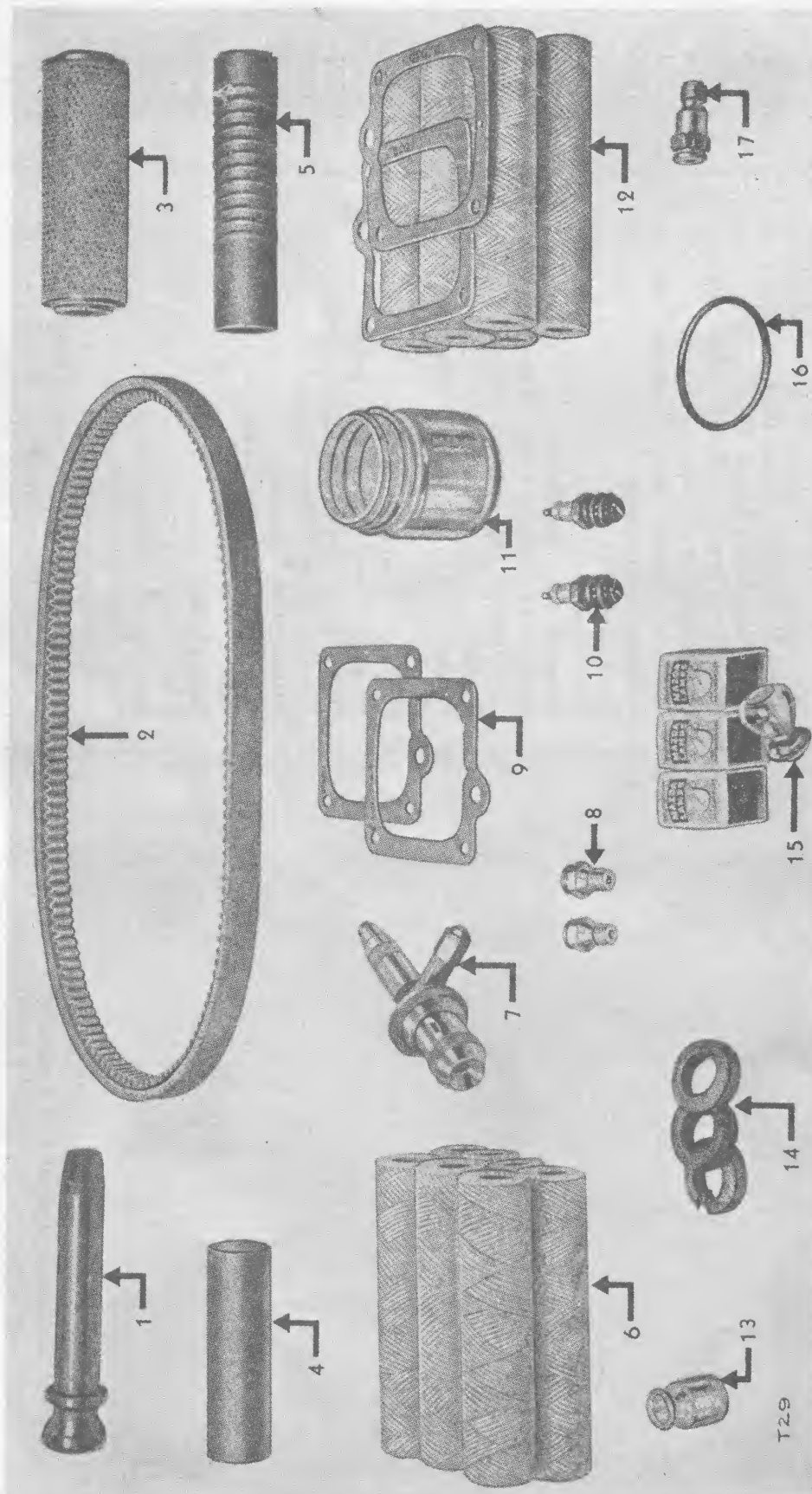


Figure 6—(sheet 1 of 2 sheets)—Parts Supplied with Tractor



Reference No.	Description	Quantity	Part No.
1	Pin (Drawbar) .....	1	7B889
2	Vee Belt (Fan) .....	2	6B6997
3	Element (Lub. Oil Filter) .....	4	4A332
4	Hose (Radiator) .....	1	17845
5	Hose (Radiator) .....	1	4A451
6	Element (Fuel Filter) .....	6	2A5886
7	Fuel Injection Valve Assembly .....	1	7B1730
* 8	Fitting (Giant Button Head) .....	2	2F1336
9	Gasket (Fuel Filter) .....	2	7B7635
10	Spark Plug .....	2	2A3643
11	Jar (Pre Cleaner) .....	1	5B2746
12	Filter Element and Gasket Assembly .....	1	7B8259
13	Sediment Bowl .....	1	F8X1-C
14	Water Pump Packing .....	1	1B8088
15	Bulb (Lamp) .....	4	9B3125
16	Pre Cleaner Jar Ring .....	1	5B3323
*17	Fitting (Giant Button Head) .....	1	3B8484
*18	Fitting (Hydraulic) .....	1	3B8490
19	Bulb (Lamp) .....	1	9B3117
*20	Fitting (Hydraulic) .....	1	3B8686
*21	Fitting (Hydraulic) .....	1	3B8489
*22	Fitting (Hydraulic) .....	1	3B8485
*23	Fitting (Hydraulic) .....	1	3B8489
24	Gasket (Sediment Bowl) .....	1	F1X1
*25	Fitting (Hydraulic) .....	1	3B8486

\* When replacement fittings are required order the standard ordnance fittings identified in figure 7.

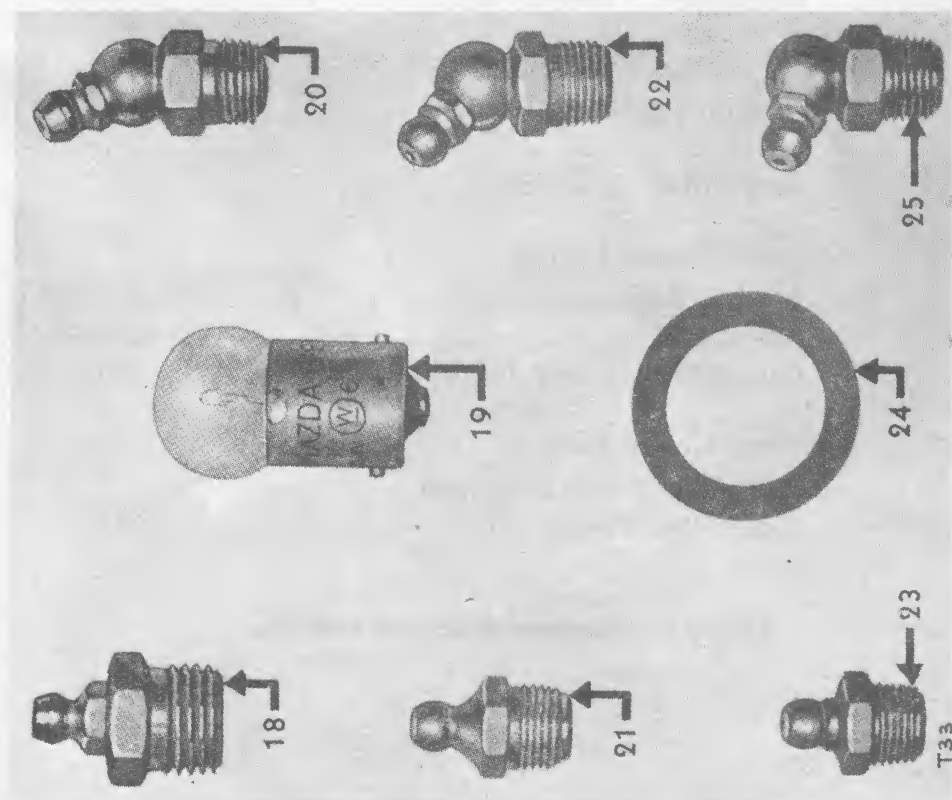
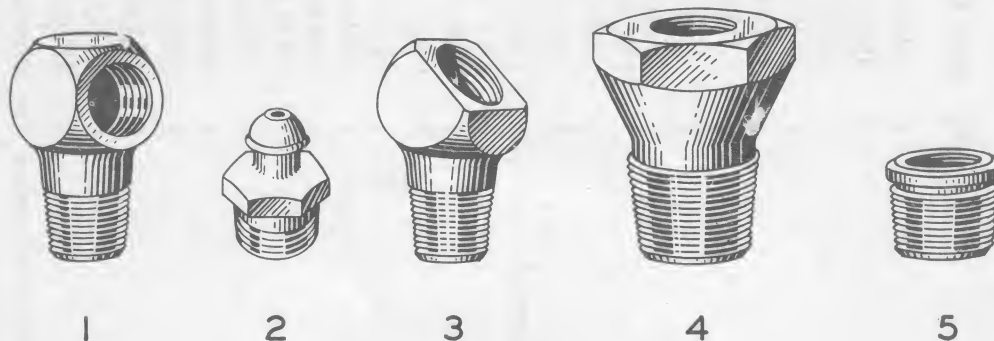


Figure 6—(sheet 2 of 2 sheets)  
Parts Supplied with Tractor



T789

**Reference No.****Part No.**

- |    |                               |         |
|----|-------------------------------|---------|
| 1. | Elbow—Grease Fitting, 90°     |         |
|    | Lincoln Engineering Co.....   | 20029   |
|    | “Alemite” .....               | 44701   |
|    | Caterpillar Tractor Co.....   | 4F2     |
| 2. | Fitting—Grease                |         |
|    | Lincoln Engineering Co.....   | 5250    |
|    | “Alemite” .....               | 1980    |
|    | Caterpillar Tractor Co.....   | 3B8489  |
| 3. | Elbow—Grease Fitting, 45°     |         |
|    | Lincoln Engineering Co.....   | 20028   |
|    | “Alemite” .....               | 43716   |
|    | Caterpillar Tractor Co.....   | 4F3     |
| 4. | Adapter—Grease Fitting        |         |
|    | Lincoln Engineering Co.....   | A-11938 |
|    | “Alemite” .....               | 306494  |
|    | Caterpillar Tractor Co.....   | 4F5     |
| 5. | Bushing—Grease Fitting        |         |
|    | Reducing 1/4 inch to 1/8 inch |         |
|    | Caterpillar Tractor Co.....   | 4F4     |

**Figure 7—Standard Ordnance Fittings**

General, Service Upon Receipt of Equipment

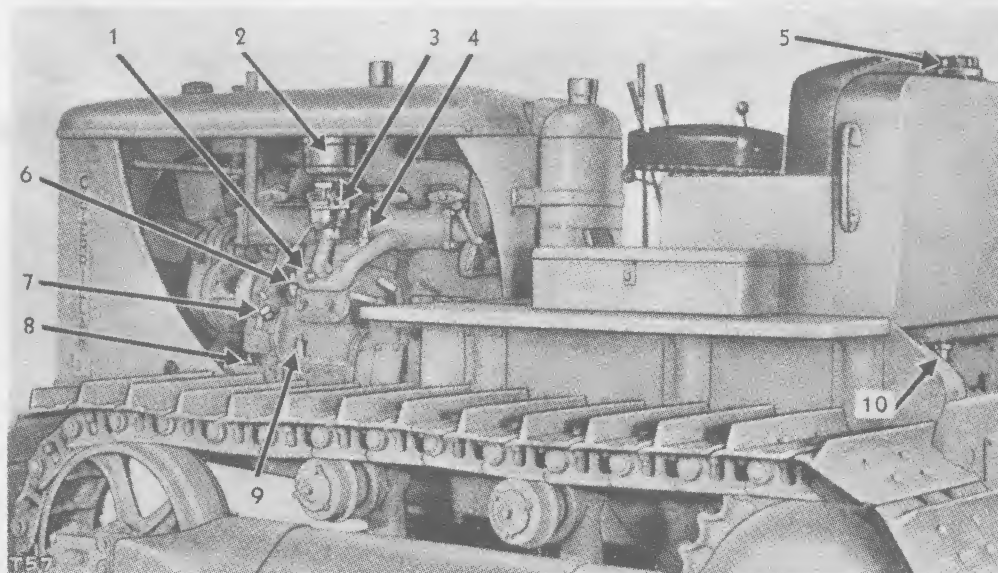
## PART TWO OPERATING INSTRUCTIONS

### SECTION IV GENERAL

#### 8. SCOPE.

Part two contains information for the guidance of the personnel responsible for the operation of this equipment. It contains information on the operation of the equipment with the description and location of the controls and instruments.

### SECTION V SERVICE UPON RECEIPT OF EQUIPMENT



1. MANIFOLD DRAIN
2. AIR CLEANER
3. CARBURETOR
4. SPARK PLUGS
5. FUEL TANK FILLER

6. BREATHER
7. OIL FILLER
8. MAGNETO
9. OIL LEVEL GAGE
10. FUEL TANK DRAIN

**Figure 8—Openings and Accessories Sealed on Left Side of Tractor**

## 9. NEW EQUIPMENT (BOXED AND PROCESSED).

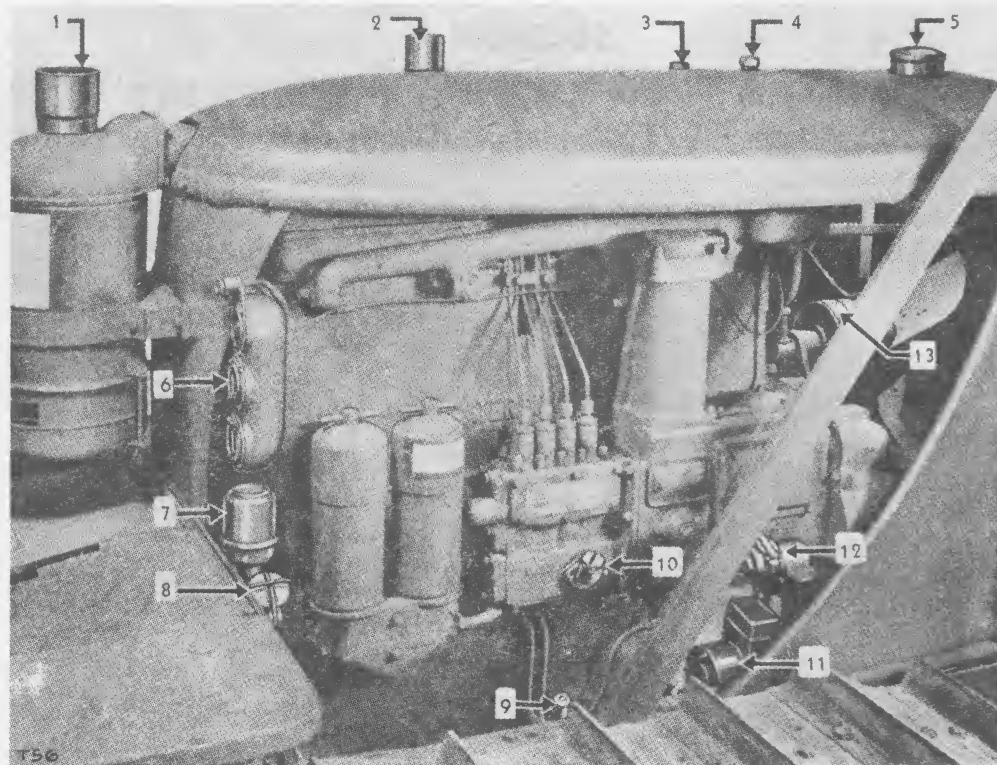
a. **General.**—New tractors and attachments are boxed and processed to meet the special demands of wartime shipping. To prevent corrosion all vulnerable openings in engines and gear compartments are sealed. Exposed moving parts and unpainted machined surfaces are covered with rust preventive compounds. This preparation makes definite services necessary before a tractor can be operated.

b. **Removing Tie Down Devices.**—Remove all tie wires, steel strapping, tie-rods, and blocking. Handle heavy parts carefully to avoid injury.

### c. Removing Seals.

(1) Remove the seals from the accessories and openings pointed out in figures 8 and 9.

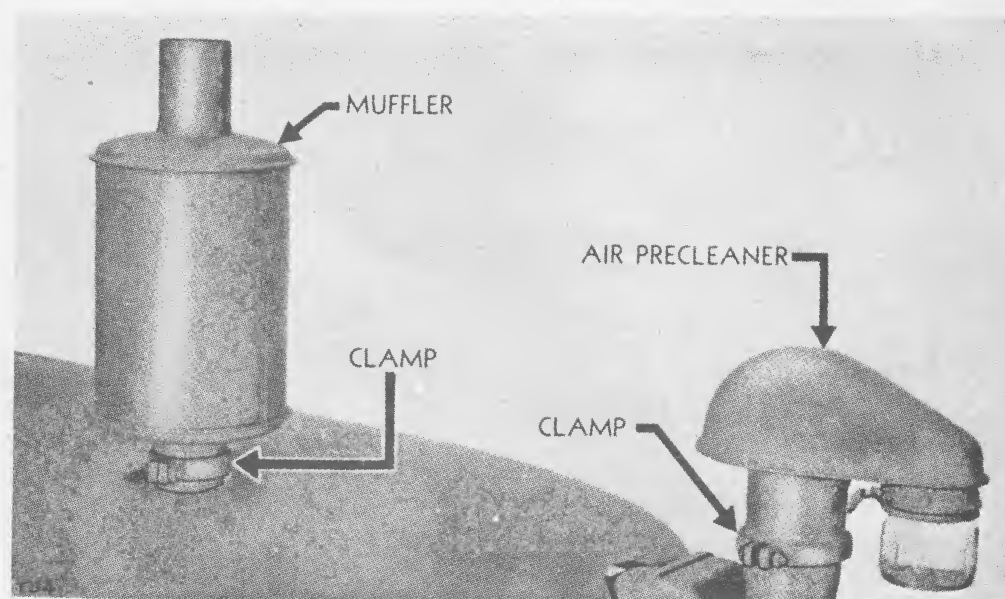
(2) Remove the paper from between the fan belts and the fan and fan drive pulleys.



- |                            |                 |                                   |
|----------------------------|-----------------|-----------------------------------|
| 1. AIR CLEANER INLET       | 5. RADIATOR CAP | 9. OIL LEVEL GAGE                 |
| 2. DIESEL EXHAUST PIPE     | 6. GAGES        | 10. INJECTION PUMP HOUSING FILLER |
| 3. STARTING ENGINE EXHAUST | 7. BREATHER     | 11. GENERATOR                     |
| 4. GASOLINE TANK FILLER    | 8. OIL FILLER   | 12. HOUR METER                    |
|                            |                 | 13. FAN BELTS                     |

**Figure 9—Openings and Accessories Sealed on Right Side of Tractor**

## Service Upon Receipt of Equipment

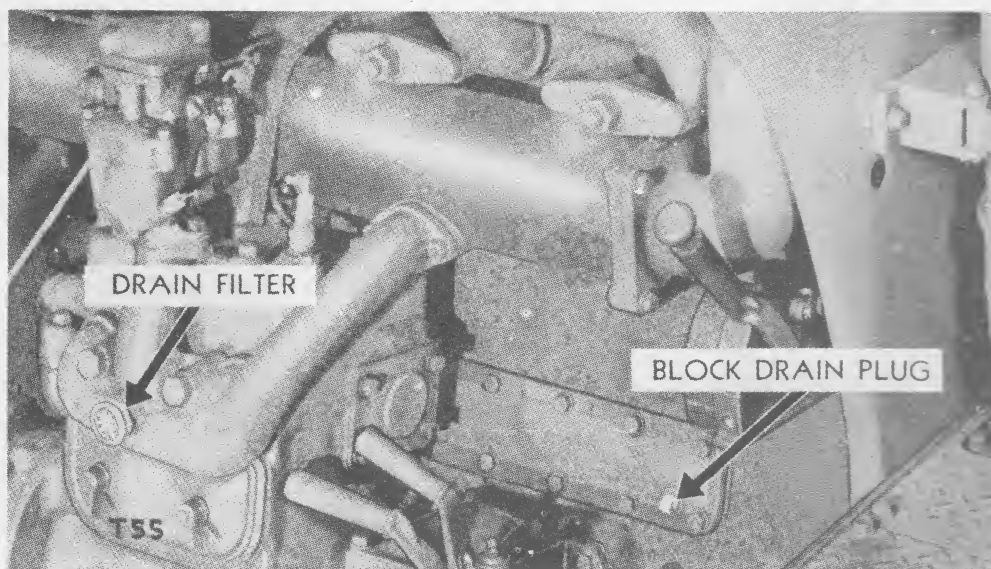


**Figure 10—Muffler and Precleaner Installed**

**d. Assembly.**

- (1) The pre-cleaner is packed on top of the starting engine transmission and the clamp is located around the forward and reverse lever. Install the pre-cleaner on top of the air cleaner. (See figure 10.)
- (2) The muffler is packed at the front of the tractor on the left side. The clamp is located around the forward and reverse lever. Attach the muffler to the exhaust pipe. (See figure 10.)
- (3) The starting engine manifold drain filter is in a sack attached to the carburetor. Screw the filter into the manifold. (See figure 11.)
- (4) The Diesel engine block drain plug is in a sack attached to the compression release lever. Screw the plug into the block. (See figure 11.)
- (5) Attach the starting engine spark plug wires to the magneto and the spark plugs.
- (6) Attach two of the lights to the front end of the tractor at the top corners of the Dozer A frame. If the tractor is not equipped with an A frame attach the lights to the top corners of the radiator guard. Attach the other two lights to the rear ends of the fenders. Be sure the paint is removed from the points of attachment and connect the wires.
- (7) Install the track shoes and be sure the bolts and nuts are tight.
- (8) Match marks are used on auxiliary equipment parts. Mate the parts with corresponding marks.





**Figure 11—Inlet Manifold Drain Filter, and Block Drain Plug Installed**

(9) Consult the applicable technical bulletin "Preparation For Export" and the auxiliary equipment technical manuals for supplementary assembly instructions. These manuals are listed in the reference section and normally accompany the tractor.

**e. Removing of Corrosion Preventive Compounds.**

(1) Corrosion preventive compounds can be removed with a steam cleaner. If a steam cleaner is not available dry cleaning solvent can be used.

(2) Drain the rust preventive from the Diesel fuel tank.

**f. Inspection.**— Inspect the tractor for missing or damaged parts and signs of tampering. Check the tools, parts and publications using the lists in paragraphs 6 and 7 as guides. Report any supplies missing.

**g. Lubrication.**— Check the oil, water and fuel supply and lubricate the entire tractor according to the lubrication order. See paragraph 33.

**h. Preparing New Batteries for Use.**

(1) Batteries shipped with a tractor contain dry charged plates but no electrolyte. Vent plugs are screwed in tight and must remain so until the cells are filled with electrolyte.

(2) Make certain the vent holes in all plugs are open.

(3) Fill cells to  $\frac{3}{8}$  inch above separators with electrolyte not warmer than 70°F. (Electrolyte is furnished with the tractor.)

(4) Do not begin to charge a new battery for several hours after adding electrolyte. Heat will be produced when the electrolyte is added, and the battery should be allowed to cool to atmospheric temperature before connection to the charger.

## Controls and Gages

(5) The charging rate for new batteries should never exceed one ampere per positive plate per cell. Watch the temperature closely; if it exceeds 110° F., reduce the rate at once.

(6) Continue the charge until three readings at hourly intervals show no further rise in specific gravity; then adjust the gravity of the electrolyte if necessary. Never discontinue an initial charge until the maximum specific gravity is obtained.

### 10. USED EQUIPMENT.

a. **General.**— Perform applicable operations outlined in paragraph 9.

b. **Inspection.**— Give a used or reconditioned tractor a thorough inspection. Check for loose nuts and capscrews, broken or missing parts. Check all adjustments. Try the transmission in all speeds. Be sure the engine is firing on all cylinders.

c. **Lubrication.**— Check the oil, water, and fuel supply and lubricate the tractor as directed in paragraph 33. Drain normally dry steering clutch and flywheel compartments.

d. **Operation.**— If the tractor has recently been reconditioned, operate under a medium load for the first 64 hours.

## SECTION VI CONTROLS AND GAGES

### 11. GENERAL:

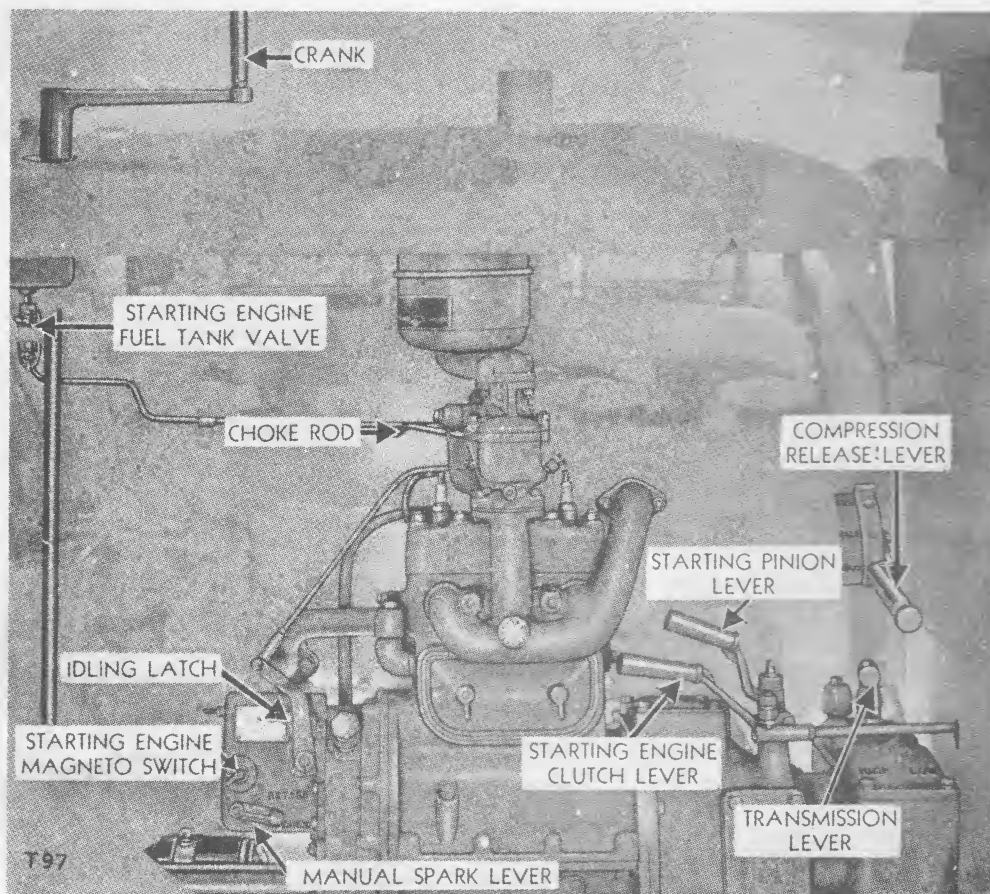
The controls are described in this section. Actual use of each control under various conditions is explained in succeeding sections.

### 12. STARTING CONTROLS. (*See figure 12.*)

a. **Starting Engine Fuel Tank Valve.**— The starting engine fuel tank valve is located directly under the fuel tank and shuts off the fuel to the starting engine carburetor.

b. **Starting Engine Choke Rod.**— The choke operates in a positive manner for three-fourths of the choke rod travel, at which position the valve is fully closed. Pulling the choke rod the last fourth of its travel, trips the positive control and the valve is then held in the closed position by spring tension. The spring tension allows the choke valve to automatically open when the engine starts which prevents flooding before the choke control rod is returned to the "OFF" position. Pushing the choke rod all the way in returns the choke to the "OFF" position and re-engages the positive control. For this reason if it is necessary to choke the engine when starting, the choke control rod should always be pulled out all the way.





**Figure 12—Location and Identification of Starting Controls**

c. **Idling Latch.**—The idling latch is provided to hold the starting engine at idling speed.

d. **Starting Engine Magneto Switch.**—The starting engine magneto switch grounds the magneto when it is turned to the “OFF” position and stops the starting engine.

e. **Manual Spark Lever.**—The manual spark control lever advances or retards the spark as desired by the operator.

f. **Compression Release Lever.**—The compression release lever is connected through a cam and push rod arrangement to the inlet valve rocker arms. When the lever is moved to the “HALF” position the compression is released on half of the cylinders. When the lever is moved to the “START” position the compression is released on all cylinders. This control is used to reduce the initial effort required to start the Diesel engine.

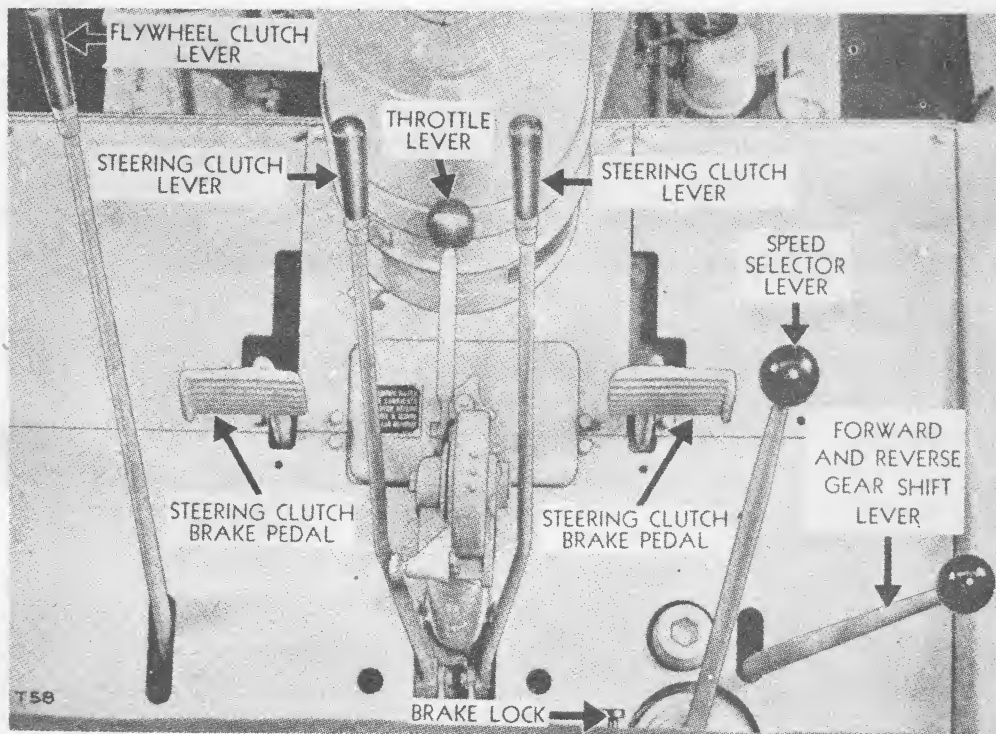
g. **Starting Engine Clutch Lever.**—The starting engine clutch lever engages the starting engine with the starter pinion when the lever is

### Controls and Gages

pulled outward and snapped over center. When the lever is pushed in toward the Diesel engine block it applies a brake to the starter pinion enabling the operator to engage it with the ring gear on the flywheel without clashing.

**h. Starter Pinion Lever.**—The starter pinion lever engages the starter pinion with the ring gear on the Diesel engine flywheel.

**i. Starting Engine Transmission Shift Lever.**—The starting engine transmission shift lever permits shifting the starting engine transmission into “HIGH” or “LOW” speed. During cold weather, or any time the oil drag in the Diesel engine slows down the starting engine so the normal cranking speed cannot be reached, the starting engine transmission can be shifted into the “LOW” speed position.



**Figure 13—Location and Identification of Operating Controls**

### 13. OPERATING CONTROLS. (See figure 13.)

**a. Throttle Lever.**—The throttle lever is used to change the governed speed of the engine. When the lever is pulled back the speed is increased. When the lever is pushed forward the speed is decreased. When the plunger on the bottom of the lever is pulled out and the lever pushed all the way forward the engine is stopped.

**b. Flywheel Clutch Lever.**—The flywheel clutch lever engages and disengages the flywheel clutch. When the lever is pulled back it snaps into engagement and remains engaged until it is pushed forward into the

clutch released position. When the clutch lever is pressed forward beyond the released position it applies a brake to the upper transmission shaft which permits gear shifting without clashing the gears.

c. **Speed Selector Lever.**—The speed selector lever is used to select the various speeds provided in the transmission. Five speeds are available in the forward direction and four of these speeds slightly higher are available in the reverse direction.

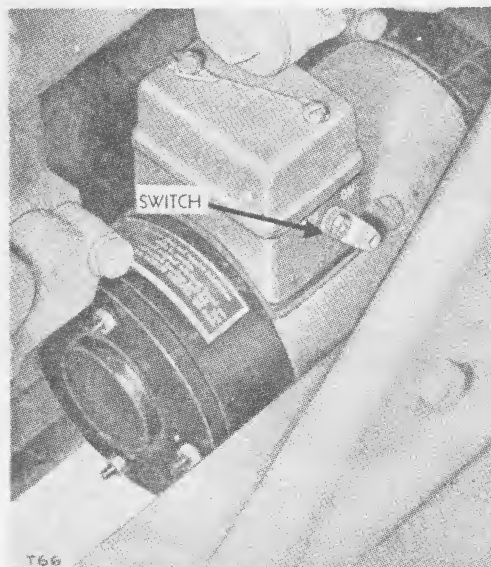
d. **Forward and Reverse Gear Shift Lever.**—The forward and reverse gear shift lever selects the direction, forward or reverse in whatever speed is selected by the speed selector lever.

e. **Steering Clutch Levers.**—The steering clutch levers enable the operator to steer the tractor. When the right lever is pulled back it disengages the power from the right track and when the left lever is pulled back the power is disengaged from the left track.

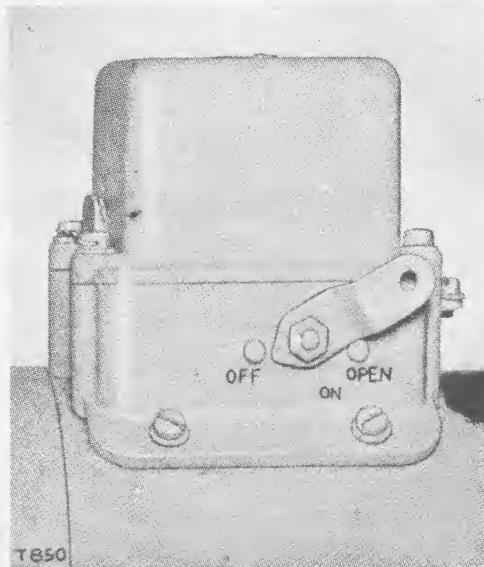
f. **Steering Clutch Brake Pedal.**—The steering clutch brake pedals operate brakes which brake the right or left track as the operator desires. These are an aid to steering or stopping the tractor. The right brake can be locked in the “APPLIED” position by pushing down on a brake lock pawl located in front of the seat near the speed selector lever.

g. **Light Switch.**

(1) On lighting systems without a battery the switch is located in the base of the voltage regulator mounted on top of the generator. (See figure 14.) To operate the switch on Auto-Lite generators turn the switch to the “OPEN” position before turning it to the “ON” position. (See figure 15.)



**Figure 14—Location of Light Switch (Bosch)**



**Figure 15 Switch Positions (Auto-Lite)**

# Controls and Gages

(2) On lighting systems with a battery the light switch is mounted on the battery box.

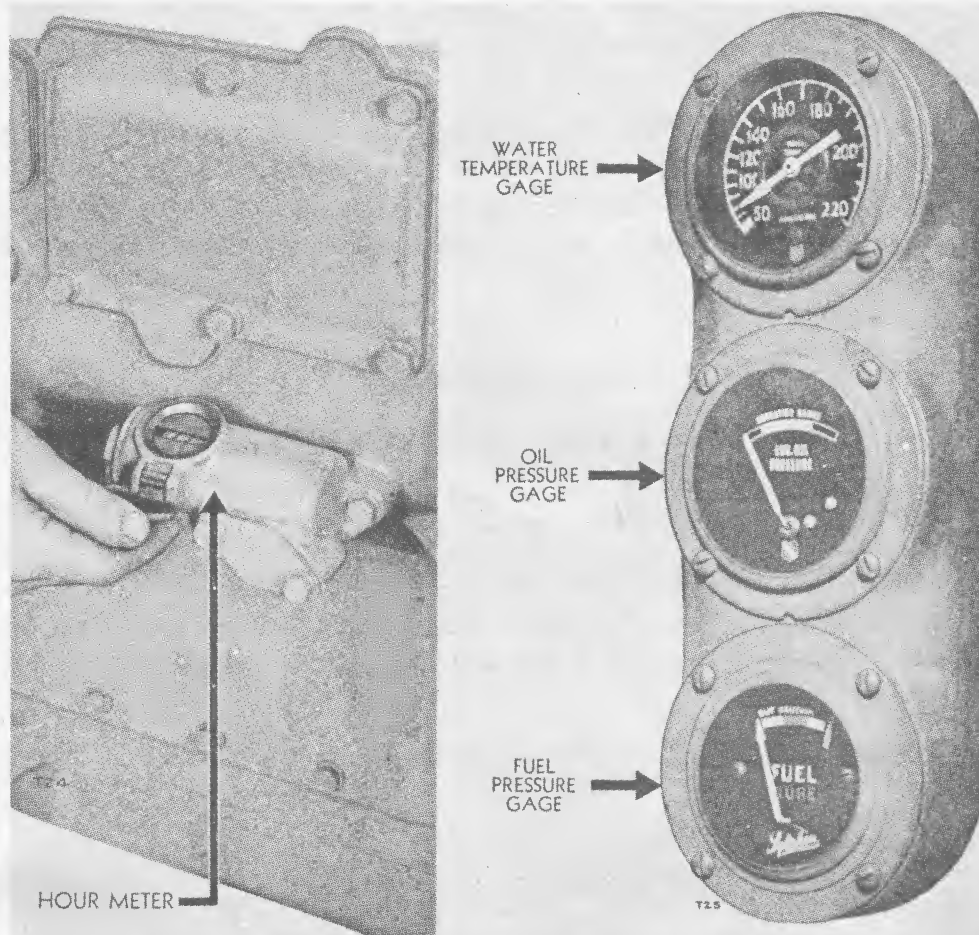


Figure 16—Gages and Hour Meter

## 14. GAGES.

a. **General.**—The gages are located on the right side of the air cleaner in front of the operator. The “Hour Meter” is located on the engine.

b. **Gages.** (See figure 16.)

(1) **TEMPERATURE GAGE.**—The temperature gage, operated through a capillary tube connected to the engine thermal unit, indicates temperature of the water in the cooling system, not quantity of water in the system. The face of the gage is graduated from 50 to 220 degrees F. The normal operating temperature of the engine is between 175° and 185°F.

(2) **OIL PRESSURE GAGE.**—The oil pressure gage indicates the pressure of the engine lubricating oil, and does not indicate the amount of oil in the crankcase. When the engine is operating the oil pressure indicator should never fall below the operating or white range on the gage.



(3) **FUEL PRESSURE GAGE.**—The fuel pressure gage indicates the condition of the fuel filters. As the filters gradually become clogged, the fuel gage indicator will move back from the normal “WHITE” range to the caution “GREEN” range and later into the out “RED” range (engine operating at normal speed).

(4) **HOUR METER.**—The “Hour Meter” is located on the right side of the engine near the bottom of the governor housing. It does not keep pace with the clock but when the crankshaft turns as many revolutions as are made in an hour at normal operating speed, the dial advances one number.

## SECTION VII

### OPERATION UNDER USUAL CONDITIONS

#### 15. GENERAL OPERATION.

a. **Preparation For Starting.** (See figures 17 and 18.)

(1) **SPEED SELECTOR LEVER.**—Place the speed selector lever in neutral. In the neutral position this lever can be moved sideways to the left or right.

(2) **THROTTLE.**—Lock the throttle in the extreme forward or “STOP” position.

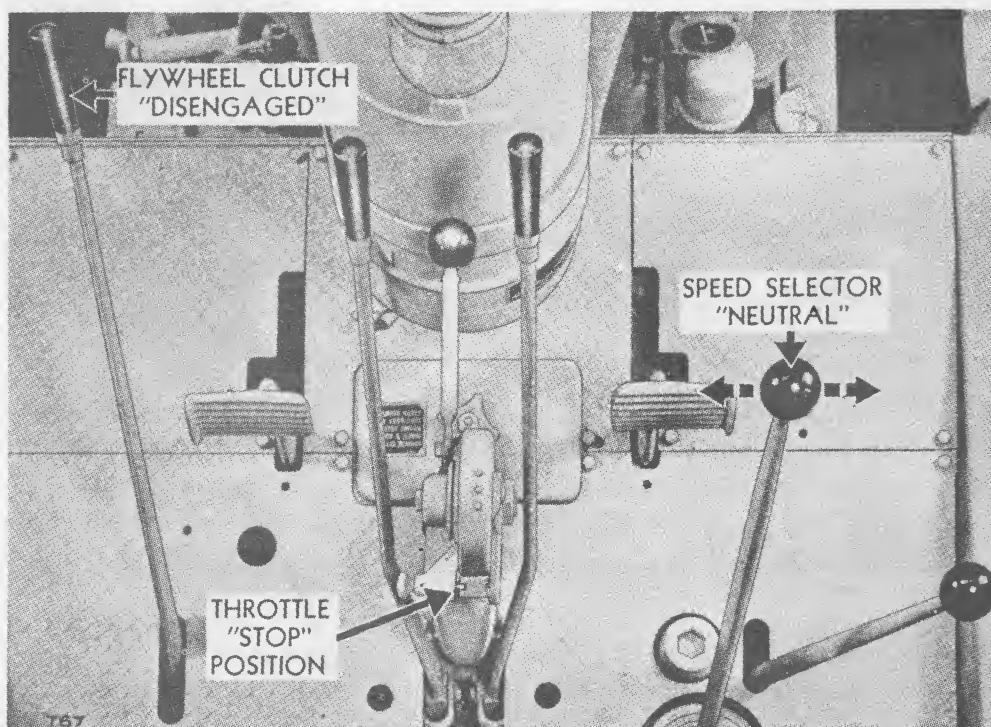


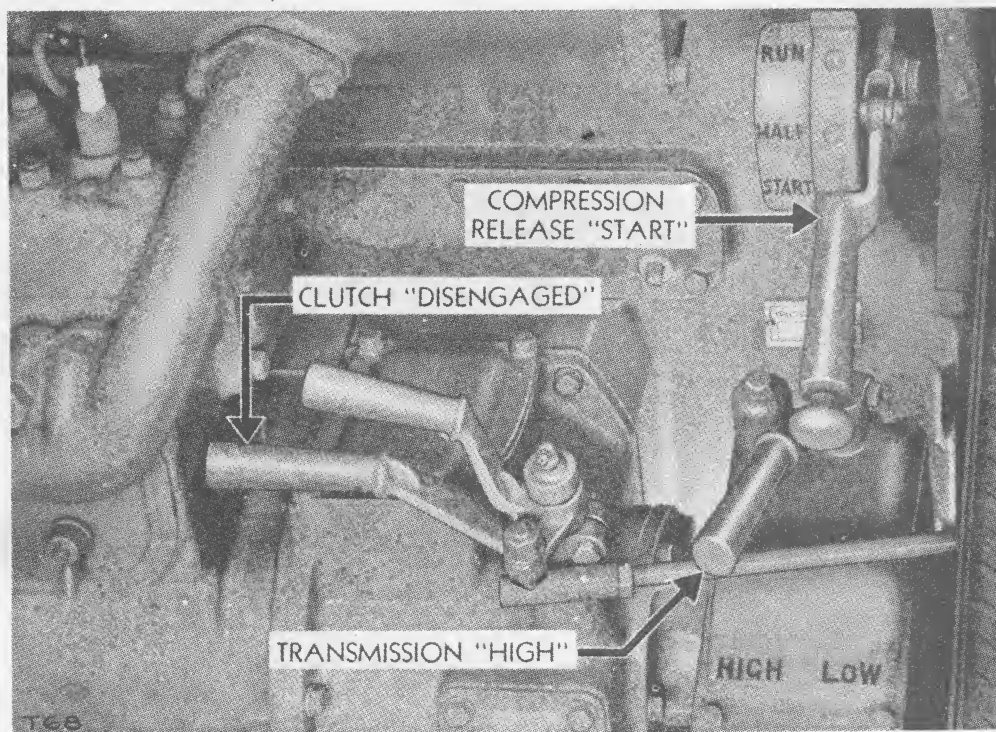
Figure 17—Operator's Controls in “Start” Position

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Operation Under Usual Conditions

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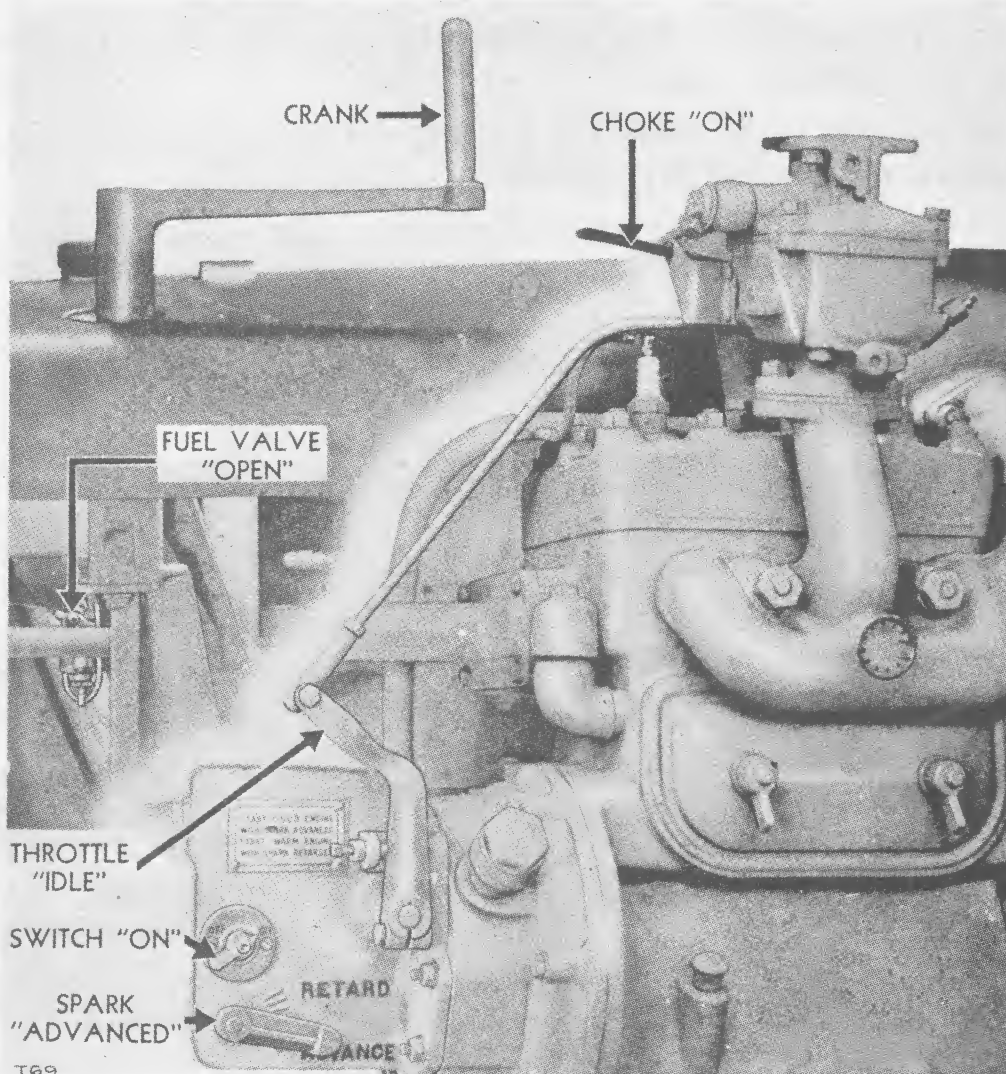
- (3) FLYWHEEL CLUTCH LEVER.—Disengage the flywheel clutch lever by pushing it forward.
- (4) COMPRESSION RELEASE LEVER.—Move the compression release lever to the "START" position.
- (5) STARTING ENGINE TRANSMISSION.—Shift the starting engine transmission into "HIGH". Use "LOW" speed for cold weather starting as directed in paragraph 22.g.
- (6) STARTING ENGINE CLUTCH.—Disengage the starting engine clutch by pushing the control lever in toward the Diesel engine block.



**Figure 18—Starting Lever Controls in "Start" Position**

**b. Starting The Starting Engine. (See figure 19.)**

- (1) CHOKE.—If the engine is cold pull the choke rod out in the choke "ON" position. If the engine is warm do not choke.
- (2) THROTTLE LEVER.—Latch the starting engine throttle lever in the idling position by dropping the idling latch in front of the lever.
- (3) SWITCH.—Turn the ignition switch "ON".
- (4) SPARK CONTROL LEVER.—If the engine is cold move the spark control lever to the "ADVANCE" position. If the engine is warm move the lever to the "RETARD" position.



**Figure 19—Starting Engine Controls in "Start" Position**

- (5) FUEL TANK VALVE.—Open the starting engine fuel tank valve.
- (6) CRANK.—Insert the crank through the opening in the hood and push down on it to engage the cranking jaw. On tractors with a side crank, insert the crank through the radiator side guard and push in on it to engage the cranking jaw.

### WARNING

Do not attempt in any manner to spin or push the crank. Pull the crank through the compression strokes.

- (7) TROUBLE SHOOTING.—If the engine will not start refer to the trouble shooting guide paragraph 39. See paragraph 22.f. for cold weather starting instructions.



## Operation Under Usual Conditions

## (8) ENGINE WARM UP.

- (a) Remove the crank.
- (b) Push the choke in to the "OFF" position.
- (c) Place the manual spark control in the "ADVANCE" position.
- (d) Permit the starting engine to warm up at idling speed before using it to start the Diesel engine.

(9) ELECTRIC STARTER. (See figure 20.)—If the starting engine is equipped with an electric starter, place the starting engine controls in the same position as described above. Then crank the engine with the electric starter by moving the control lever back to engage the drive gear, at the same time contacting the starter switch.

In some instances, when attempting to engage the starter drive, it will be found that resistance to movement of the control lever occurs before the starter switch is contacted. This is due to the starter sliding gear failing to mesh properly with the mating gear on the flywheel of the starting engine. To correct, pull out on the knurled knob of the gear rocker, located in the starter mounting bracket, and turn the knob until the sliding gear meshes, permitting continued movement of the control to contact the starter switch.

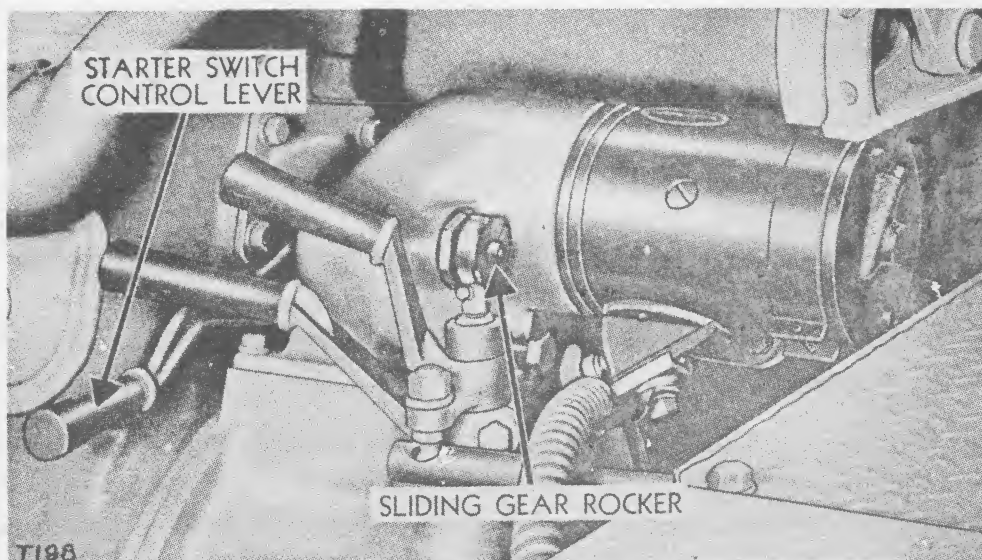
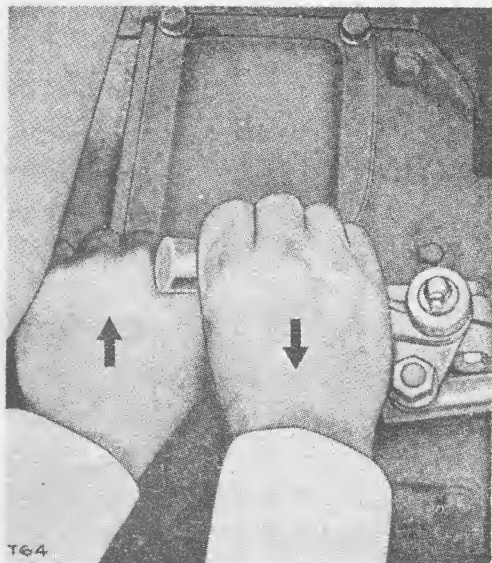


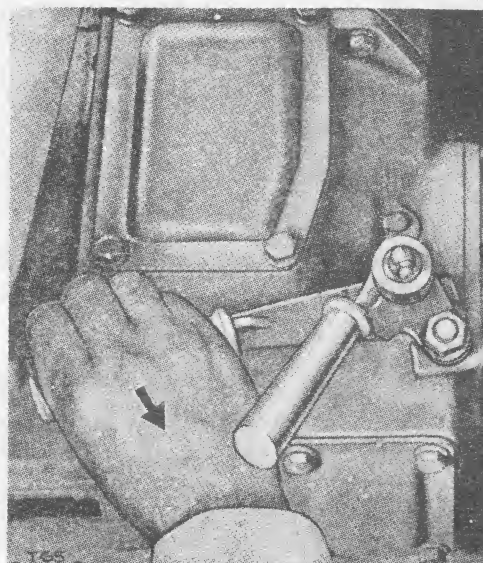
Figure 20—Electric Starter Control

### c. Starting The Diesel Engine.

(1) **ENGAGE THE STARTER PINION.** (*See figure 21.*)—Push in on the clutch control lever to stop the pinion from rotating, and prevent it from clashing with the flywheel ring gear. At the same time pull out on the pinion control lever as far as possible. This engages the starter pinion with the flywheel ring gear.



**Figure 21—  
Engaging the Starter Pinion**



**Figure 22—Engaging  
the Starting Engine Clutch**

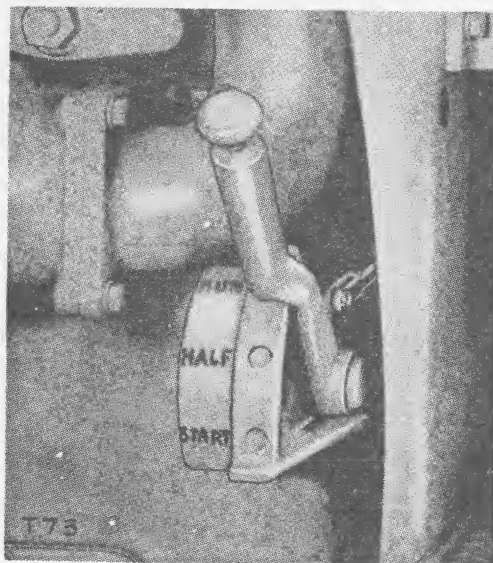
(2) **RELEASE THE STARTING ENGINE IDLING LATCH.**—When the idling latch is lifted and the throttle lever moves forward, the starting engine will run at full governed speed.

(3) **ENGAGE THE STARTING ENGINE CLUTCH.** (*See figure 22.*)—Engage the starting engine clutch by pulling the clutch control lever out as far as possible.

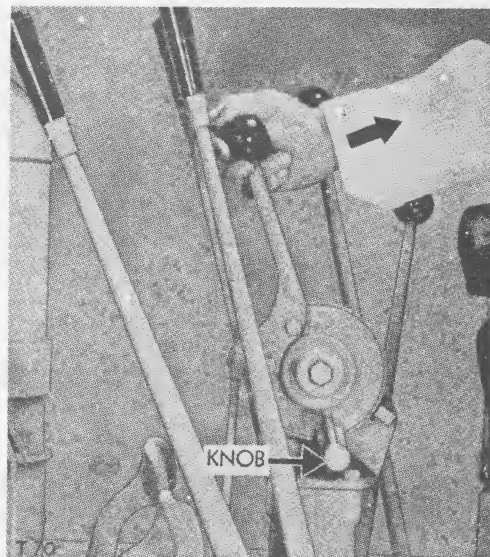
(4) **MOVE THE COMPRESSION RELEASE LEVER TO THE “RUN” POSITION.** (*See figure 23.*)—Move the compression release lever to the “RUN” position as soon as the starting engine will turn the Diesel engine at normal cranking speed.

(5) **ALLOW THE DIESEL ENGINE TO WARM UP.**—When the starting engine is cranking the Diesel engine against compression (with the compression release lever in the “RUN” position) the heat of compression helps warm the cylinders, pistons and combustion chambers to the temperature necessary for starting.

Operation Under Usual Conditions



**Figure 23—Compression Release Lever in "Run" Position**



**Figure 24—Pulling Back the Throttle to Start the Diesel Engine**

(6) PULL THE DIESEL THROTTLE CONTROL LEVER BACK ABOUT HALF WAY. (See figure 24.)—After the starting engine has cranked the Diesel engine against compression until the Diesel is sufficiently warm and the lubricating oil pressure gage indicator is registering in the "OPERATING RANGE", pull out the plunger stop and pull the throttle control lever back about half way.

(7) TROUBLE SHOOTING.—If the engine does not start refer to the trouble shooting guide, paragraph 40. Cold weather starting directions are given in paragraph 22.g.

(8) PINION DISENGAGEMENT.—When the Diesel begins to fire, the starter pinion disengages automatically.

(9) DISENGAGE THE STARTING ENGINE CLUTCH.—Disengage the starting engine clutch by pushing the clutch control lever in toward the engine.

(10) IDLE THE STARTING ENGINE.—Latch the starting engine throttle in the idling position.

(11) STOP THE STARTING ENGINE.—Stop the starting engine by closing the valve under the starting engine fuel tank, allowing the engine to burn all the fuel in the carburetor.

(12) WARM UP THE DIESEL ENGINE.—Allow the Diesel engine to idle five minutes with the throttle at least half open and five minutes at full speed before applying the load.

### WARNING

The complete observance of one simple rule would prevent many serious injuries. That rule is: Never attempt to clean, oil or adjust a machine while it is in motion.

#### d. Driving The Tractor.

- (1) When the engine is warm, move the throttle control lever to the idling position.
- (2) Disengage the flywheel clutch by pressing the clutch control lever forward. To permit shifting gears without clashing continue to press forward on the clutch lever until the clutch stops rotating.

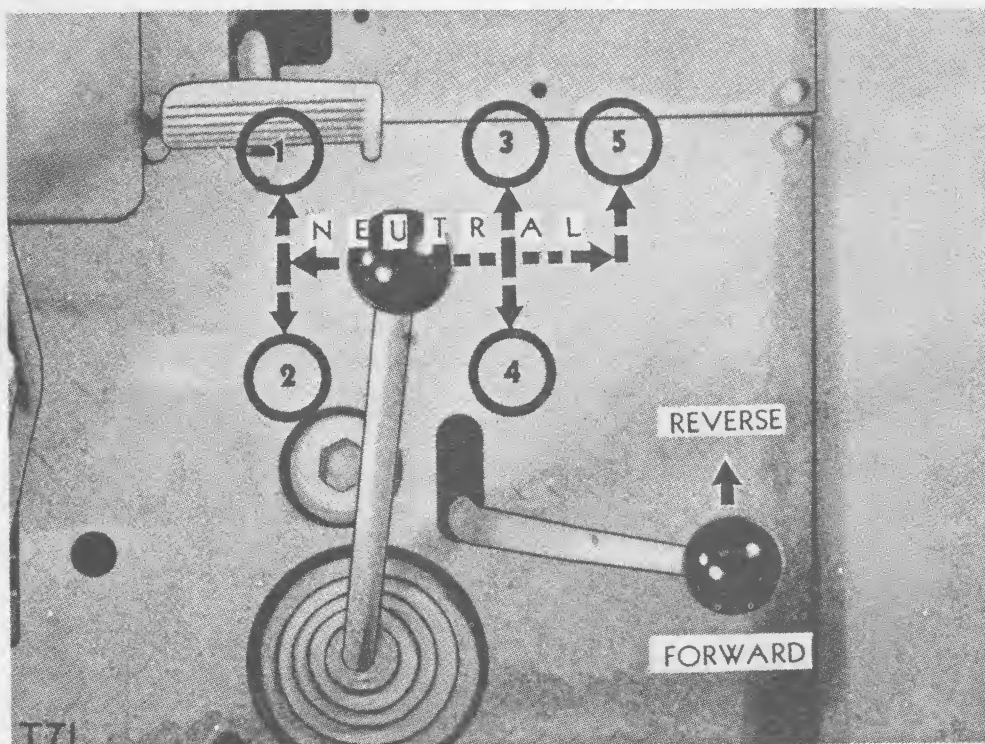


Figure 25—Gear Shift Lever Positions

(3) Carefully move the speed selector lever (inside lever) into position for the speed desired. A diagram of the gear shift positions is shown on the air cleaner and the positions are illustrated in figure 25. Always shift gears completely into mesh.

(4) After the speed is selected move the forward and reverse lever (outside lever) into either the forward or reverse position as desired. All but the fifth speed are available in the reverse direction at a slightly higher speed. When traveling in fifth speed forward, however, the forward and reverse lever should be placed in the forward direction position.



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Operation Under Usual Conditions

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(5) Pull the throttle control back. Carefully engage the flywheel clutch until the slack is taken up between the tractor and the load. Then pull the clutch lever back firmly until it snaps over center.

**e. Steering The Tractor.**

(1) Pull the steering clutch lever all the way back on the side toward which the turn is to be made.

A light pull on the steering clutch lever is sufficient to operate the steering clutches. Actually, the only work done by the operator is that of opening a valve, as the steering clutches are released hydraulically by a control unit driven from the upper transmission shaft. If the oil pump fails for any reason the tractor may be manually controlled by the steering clutch levers.

(2) Apply the brake on the same side that the steering clutch was released on by pressing down on the brake pedal hard enough to turn at the desired angle.

(3) Both the brake and steering clutch controls should be handled smoothly so the turn will be made evenly and not as a series of jerks. Just before the turn is completed release the brake, then engage the steering clutch by releasing the control lever smoothly.

(4) The brake must be in the fully released position during normal operation of the tractor. Keep the feet off the pedals except when it is necessary to apply the brakes. With a load behind the tractor it is seldom necessary to use the brakes in steering except for sharp turns, since the load acts as a brake. The right brake pedal may be locked in position to hold the tractor on slopes.

**f. Stopping The Tractor.**

(1) Disengage the flywheel clutch.

(2) Move the throttle control to the idling position.

(3) Shift the speed selector lever into neutral.

(4) Leave the forward and reverse lever in either the forward or reverse position.

(5) Engage the flywheel clutch. Do not allow the tractor to idle with the flywheel clutch disengaged.

**g. Stopping The Diesel Engine.**

(1) Allow the engine to idle five minutes with the throttle half open before stopping.

(2) Move the throttle control lever to the "STOP" position.



- (3) Shift the compression release lever to the "START" position.
- (4) Leave the main fuel tank valve open.
- (5) If the tractor must stand without shelter, cover the exhaust pipes to exclude rain or snow. If the temperature is below freezing, or if freezing weather is expected before the engine will be started again drain the cooling system, (See paragraph 6l.b.) or protect it with an anti-freeze solution. See paragraph 22.

## 16. SPECIFIC OPERATION.

a. **Operating Over An Obstruction.**—The fact that the steering clutches are controlled by separate levers may be used to advantage in running over an obstruction, such as a log or a ditch bank. Both of the clutches may be released slightly until the tractor balances on top of the obstruction. Then one clutch may be engaged gradually so that the tractor moves forward at an angle, over and down. If the tractor is being operated without a load it may be necessary to use the brakes.

b. **Steering The Tractor Down Grade.**—When going down grade with the tractor pulling the load, steer in the usual manner. If the load is pushing the tractor, the operation of the steering clutches is reversed. For example, to turn to the right under these conditions, release the steering clutch on the left, but do not apply the brake. This allows the left track to travel faster while the right track is held back by the engine which acts as a brake.

## SECTION VIII

### OPERATION OF AUXILIARY EQUIPMENT

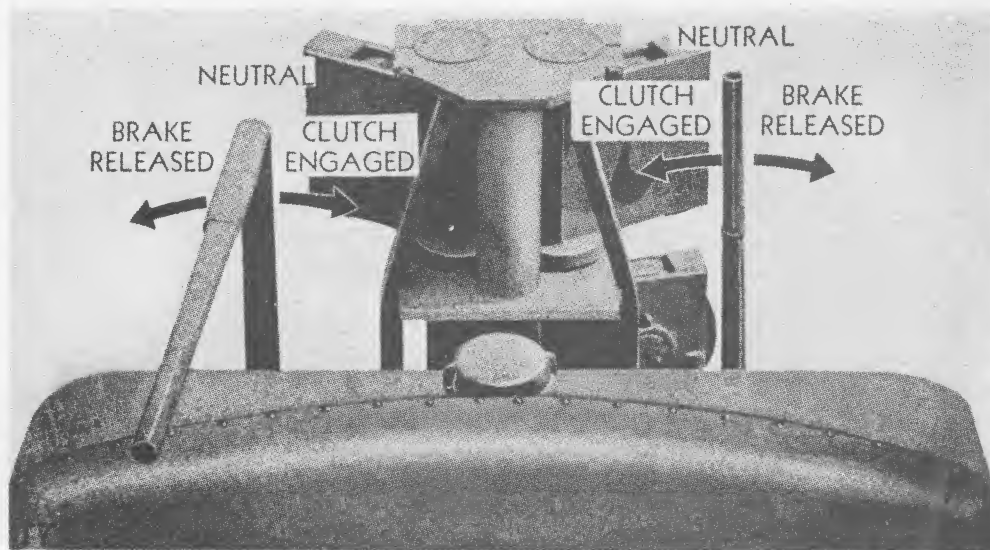
## 17. GENERAL.

This section identifies and describes various controls used to operate the auxiliary equipment described and illustrated in part four. Consult the applicable Technical Manual for detailed instructions on lubrication and operation. The auxiliary equipment Technical Manuals are listed in paragraph 106.

## 18. LeTOURNEAU R7 POWER CONTROL UNIT.

a. **General.**—Before placing a new Power Control Unit in operation, the oil level should be checked and the cork should be removed from the breather hole in the oil filler plug. This cork is placed in the filler plug at the factory to prevent oil leakage during shipment. Unless the cork is removed, a pressure will be built up inside the gear case when the unit is placed in operation, forcing oil out around the oil seals.

Operation of Auxiliary Equipment



**Figure 26—LeTourneau R7 Power Control Unit Levers**

b. **Controls.**—The control levers are illustrated in figure 26. Each lever controls a drum on the double drum cable control.

(1) When a lever is moved in the clutch engaged direction, the drum will turn and reeve on cable. This will lift a Dozer blade or regulate the loading and ejection of cable controlled scrapers.

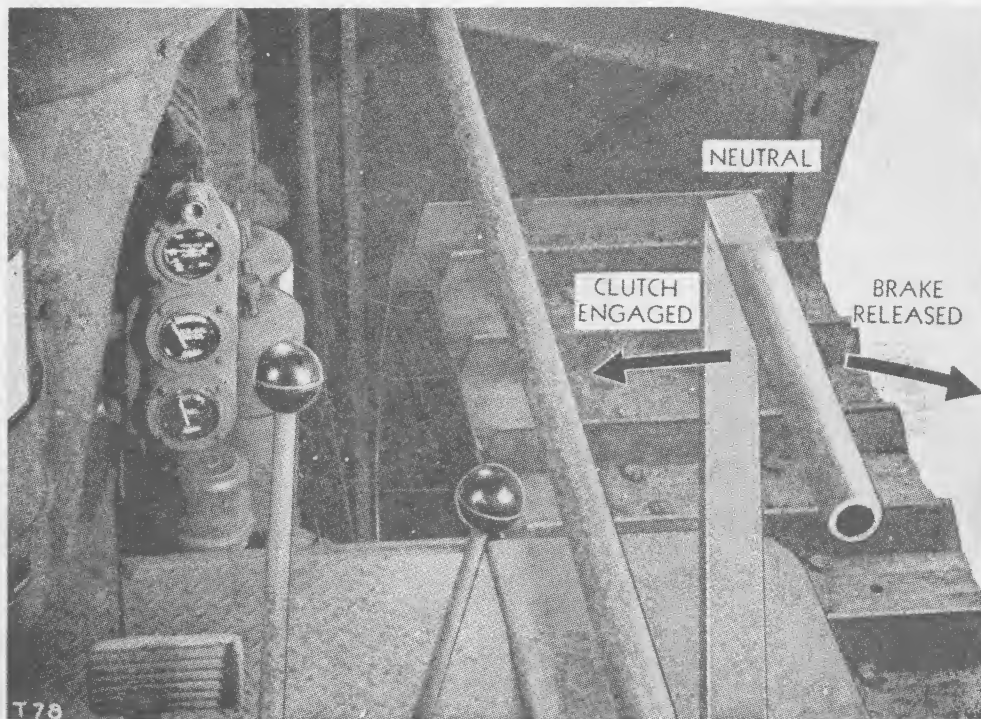
In order to avoid clutch and brake slippage, and the resultant overheating of the Power Control Unit clutches and brakes, the operator should always fully engage and disengage the clutch with a quick full movement of the control lever. Overheating of the Power Control Unit from improper operation may cause the leather in the oil seals to harden and result in oil leakage.

(2) When a lever is moved into the neutral position the clutch is disengaged and the brake is engaged. This causes the drum to stop turning.

(3) When a lever is moved into the brake released position the brake is released and the force pulling back on the cable unspools the cable off the cable drum. This unspooling can be stopped by returning the control lever to the neutral position.

## 19. LeTOURNEAU FTD7 FRONT POWER CONTROL UNIT.

a. **General.**— Before operating the power control unit check the oil level in the gear case, and remove the cork from the breather hole in the oil filler plug.



**Figure 27—LeTourneau FTD7 Front Power Control Unit Lever**

**b. Controls.**

- (1) When the hand lever, (See figure 27.) located on the right side of the seat is pulled toward the operator the clutch is engaged and the angledozer or bulldozer blade will be lifted.
- (2) When the lever is in the center position the clutch is disengaged, the brake is applied and the blade is held in position.
- (3) When the lever is pushed outward the brake is released and the blade drops.

**20. HYSTER WINCH.**

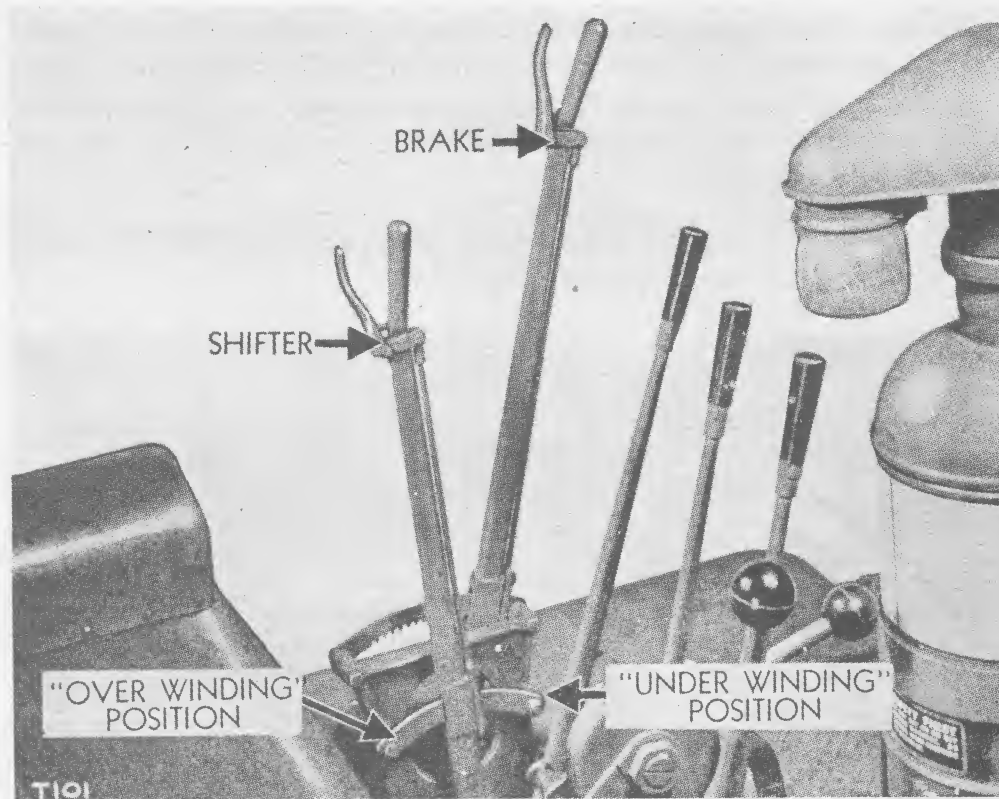
a. **General.**— Before operating the winch the oil level should be checked. The filler hole, provided with a pipe plug is located in the top cover of the transmission case.

b. **Controls.** (See figure 28.)—The brake and shifter levers are located on the left side of the operator. A pawl and ratchet are provided to hold the brake lever in the “APPLIED” position.

**CAUTION**

The brake should always be released before attempting to operate the winch, otherwise serious damage will result. The tractor flywheel clutch should be disengaged before shifting gears in the winch.

## Operation of Auxiliary Equipment



**Figure 28—Hyster Winch Control Levers**

**c. Shifter Lever.**

(1) When the winch is used with the cable leading from the top of the drum, the drum is "OVERWINDING". To wrap the cable around the drum or pull in a load the shifter lever should be moved into the rear position on the sector. The center position is neutral.

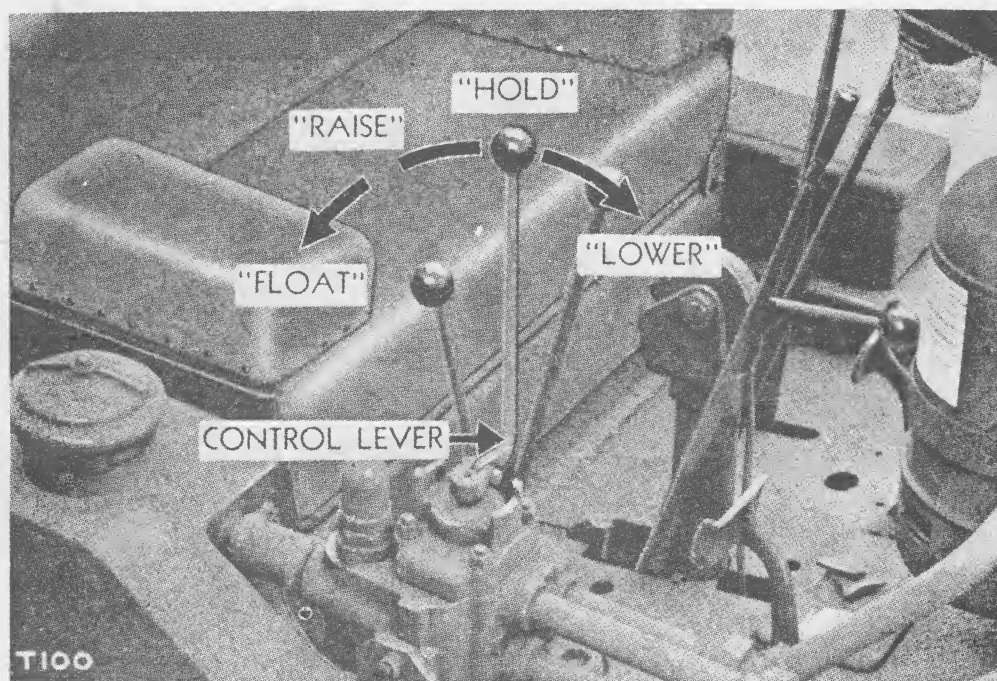
(2) When the winch is used with the cable leading from the bottom of the drum, it is said to be "UNDERWINDING". To wrap the cable around the drum or pull in a load the shifter lever should be moved into the forward position on the sector.

**d. Brake.**

(1) The brake hand lever is the longest lever. When this lever is pushed forward the brake is released; when it is pulled back the brake is applied. The brake is an external contracting band type which is cam operated. Care should be exercised to apply the brake ONLY when the tractor flywheel clutch is disengaged, otherwise the tractor engine will be stalled and damage could result to the winch mechanism.

(2) If not otherwise specified, all winches are shipped with the brake set up for the drum to be pulling the cable in "OVERWINDING" (over the top of the drum barrel). If the brake is used with the incorrect setting, it will be much harder to apply and the load will be difficult to hold.

(3) To make the necessary brake adjustments for "UNDERWINDING" cable, consult the Hyster Technical Manual.



**Figure 29—LaPlant Choate Hydraulic Control Lever Positions**

## **21. LaPLANT - CHOATE HYDRAULIC CONTROL ON R71 TRAIL-BUILDER.**

a. **General.**—In preparing the machine for operation, first check the oil level in the oil supply tank. The tank should be filled within 5 inches of the top with motor lubricating oil.

b. **Control.** (See figure 29.)—The valve is designed with four control positions.

(1) "HOLD" position — The lever should be parallel to the tractor seat or crosswise with regard to the tractor.

(2) "HOIST" position — The lever should be pulled back 45° from "HOLD" position.

(3) "DOWN" position — The lever should be pushed forward 45° from "HOLD" position.



Operation Under Unusual Conditions

(4) "FLOAT" position — The lever may be moved back or forward 90° from "HOLD" position, or parallel with the line of travel of the tractor.

(5) The valve has two "HOLD", two "HOIST", two "DOWN" and two "FLOAT" positions, since the control lever can be reversed to the opposite side of the valve. Either position may be used with the same accuracy of control.

**CAUTION**

Do not leave valve on "HOIST" or "DOWN" pressure position after jack has traveled its full stroke. This causes oil to be forced through relief valve under pressure and causes overheating which will damage the hydraulic system.

**SECTION IX**  
**OPERATION UNDER UNUSUAL CONDITIONS**

**22. COLD WEATHER OPERATION.**

a. **General.** — Low temperatures make additional preparation and maintenance necessary to assure starting and prevent damage to the tractor.

b. **Protection Of The Cooling System.**

(1) Compound, antifreeze (ethylene glycol type) is prescribed for use as an antifreeze solution. The following table gives the quantity required to protect the cooling system of this tractor at the indicated temperatures.

Temperature	Quarts Ethylene Glycol
10°F.....	18 qt
0°F.....	22½ qt
— 10°F.....	27 qt
— 20°F.....	31½ qt
— 30°F.....	36 qt
— 40°F.....	40½ qt
— 50°F.....	40½ qt
— 60°F.....	45 qt

(2) The following precautions should be taken before installing the antifreeze compound.

(a) Flush the cooling system thoroughly, if necessary remove the scale as described in paragraph 61.

(b) Check the cooling system for leaks. Replace hoses and pump packing if they show signs of deterioration.

(c) Inspect the fan belt. Adjust or replace if necessary.

**c. Lubrication.**

Lubrication at temperatures below 0°F. is covered in the lubrication order. (See figure 32.)

**d. Fuel System.**

(1) In sub-zero weather use Grade X Diesel fuel.

(2) The following precautions should be taken to avoid the formation of ice in the fuel system.

(a) Always keep the fuel tank as full as possible, this will reduce condensation of water from the free air space above the fuel.

(b) Use precaution when handling fuel to prevent the entrance of snow or ice.

(c) Open the fuel tank drain cock and remove the filter housing drain plug regularly to drain off accumulated water.

**e. Battery.**—The battery should be tested with a hydrometer and kept within a margin of safety to a specific gravity of 1.275 to 1.300. A dangerously low point of charge is indicated by a hydrometer reading of 1.150 which will permit the battery to freeze. A specific gravity of 1.250 will permit the battery to withstand temperatures as low as —30°F. without freezing.

**CAUTION**

In sub-zero weather water should not be added to the battery until just before the tractor is operated. Operation is necessary to charge the battery and mix the water with the electrolyte to prevent it from freezing.

**f. Starting The Starting Engine.**—The following instructions are intended to supplement the starting procedure covered in paragraph 15.

(1) Fill the fuel tank with fresh gasoline.

(2) Before every start, see that there is no ice on the spark plugs, wiring or magneto.

(3) Sometimes moisture will collect on the starting engine spark plugs. Dry the plugs by pouring gasoline over the electrodes and igniting it.

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Operation Under Unusual Conditions

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(4) Pouring a small amount of gasoline on spark plug electrodes before they are replaced is more effective in promoting combustion than priming the cylinders with raw gasoline.

**g. Starting The Diesel Engine.**—The following instructions are intended to supplement the starting procedure covered in paragraph 15.c.

(1) **STARTING ENGINE TRANSMISSION.**—The starting engine transmission provides a “LOW” speed to help the starting engine start to crank the cold Diesel engine. Be sure the starting engine clutch is disengaged and the Diesel engine flywheel has stopped turning before the transmission is shifted. Shift the transmission into “HIGH” to start the Diesel.

(2) **COMPRESSION RELEASE LEVER.**—When the oil “drag” of the Diesel engine prevents the starting engine from turning the Diesel engine fast enough to start it, move the compression release lever to the “HALF” position. When the lever is in this position, the compression is released on half of the cylinders and allows faster cranking. Move the compression release lever to “RUN” as soon as the starting engine can turn the Diesel engine with the lever in that position.

## **23. HOT WEATHER OPERATION.**

### **a. Cooling System.**

(1) In extremely high temperatures the water in the cooling system should be checked more frequently than under normal conditions.

(2) Inspect the fan belt adjustment at frequent intervals.

(3) Keep trash out of the fins in the oil cooler and water radiator cores.

(4) Use only clean water. Avoid the use of water that contains alkali or other substances which may cause scale formation.

(5) If the engine overheats have the water temperature regulator and water pump checked.

**b. Lubrication.**—Special attention should be given to lubrication. Consult the lubrication order (See figure 32.) and the instructions in paragraph 34.

**c. Battery.**—In torrid zones, cell water level should be checked daily and replenished if necessary with pure distilled water.

## 24. OPERATING IN DEEP MUD OR WATER.

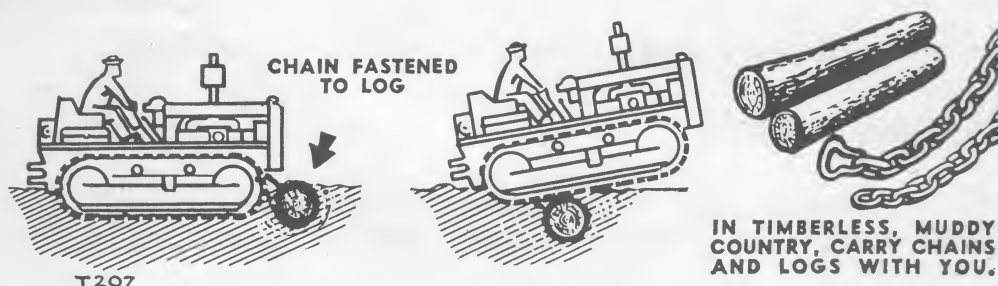
a. **Lubrication.**—Special attention should be given to lubrication. Consult the lubrication order (See figure 32.) and the instructions in paragraph 34.

b. **Fan.**—If there is danger of dropping into deep water, remove the fan belt to prevent the fan from pulling into the radiator.

c. **Freeing Stuck Tractor.**—When a tractor mires down in deep mud there are several ways to get out without the aid of another tractor.

(1) **WINCH.**—If the tractor is equipped with a winch it may be possible to run the winch line out and anchor it to a tree or rock. When the line is anchored the tractor can winch itself out.

(2) **LOGS AND CHAIN.**—If logs and chain are available lay a log across the front or rear of the tractor and fasten it by some means to the track shoes. The tractor will pull itself out as illustrated in figure 30.



**Figure 30—Procedure for Using Logs and Chains to Free a Stuck Tractor Illustrated**

## 25. OPERATING IN OR NEAR SALT WATER.

In addition to the precautions listed in paragraph 24, take the following steps after operation:

a. **Draining.**—Drain normally dry compartments.

b. **Flushing.**—If fresh water is available flush the entire tractor.

c. **Lubrication.**—Lubricate the entire tractor as directed in paragraph 33.

## 26. OPERATING IN ROCK, STUMPS, DEBRIS.

- a. **Guards.**—Make sure crankcase and radiator guards are in place and securely fastened.
- b. **Track Adjustment.**—Check the track adjustment. If it is too loose the track is apt to be forced off the rollers.
- c. **Speed.**—Use moderate speed and operate over large obstructions with care.

## 27. OPERATING IN HIGH ALTITUDE.

- a. **General.**—As altitude increases the density of the air decreases and therefore the weight of oxygen in a given volume of air decreases. The volume of fuel that can be burned and the horsepower developed within the cylinders will likewise decrease.

- b. **Graph.**—The power consumed between the engine and the drawbar will vary slightly with the speed and tractive conditions, but the accompanying graph, (See figure 31.) may be considered sufficiently accurate for estimating purposes.

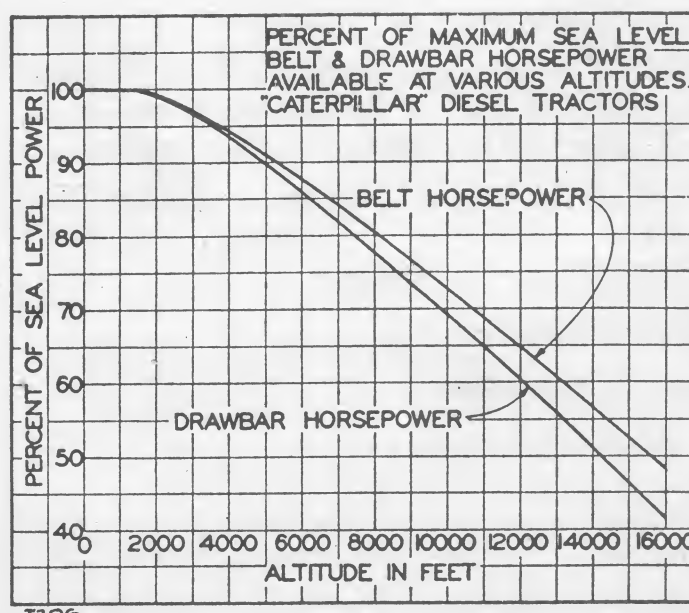


Figure 31—Altitude Horsepower Loss Curve



c. **Calculation.**—To obtain the pounds pull available at various altitudes multiply the pounds pull given for sea level conditions (refer to tabulated data) by the percentage shown in the graph for drawbar horsepower. Example:

Sea level drawbar pull, first speed = 21,351 lb.

At 12,000 ft. altitude, drawbar pull = 60% of sea level drawbar pull.

$21,351 \times .60 =$  drawbar pull of 12,810.60 lb.

## SECTION X

### DEMOLITION OF EQUIPMENT

#### 28. GENERAL.

a. **Necessity For Demolition.**—Tactical situations may arise when, owing to limitations of time or transportation it will become impossible to evacuate all tractors. In such situations it is imperative that every tractor which cannot be evacuated be destroyed to prevent its capture intact by the enemy.

b. **Principles Of Demolition.**

(1) The destruction of tractors subject to capture or abandonment in the combat zone, will be undertaken only when in the judgment of the military commander concerned such action is necessary.

(2) The same essential parts must be destroyed on all like units to prevent the enemy from constructing one complete unit from several damaged ones, by cannibalization.

(3) When practical, mobile equipment should be demolished in places where the wreckage will provide the maximum impediment to enemy movements such as on highways and airfield runways.

(4) The method of demolishing must be determined by the material and time available.

#### 29. METHODS OF DEMOLITION.

a. **Demolition By Explosives.**

- (1) Remove and empty portable fire extinguishers.
- (2) Puncture fuel tanks.
- (3) Place 2 lb. of TNT on main gear housing of power take off unit.
- (4) Place 1 lb. of TNT on left side of engine as low as possible.
- (5) Place 1 lb. of TNT on flywheel clutch.

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Demolition of Equipment

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- (6) Place 2 lb. of TNT on transmission housing adjacent to shift levers.
- (7) Place 2 lb. of TNT on starting engine against left cylinder block wall.
- (8) Place 1 lb. of TNT on Hydraulic Pump casing.
- (9) Place 2 lb. of TNT at center of each track frame assembly.
- (10) Insert tetryl nonelectric caps with at least 5 feet of safety fuse in each charge placed.
- (11) Ignite fuses and take cover.
- (12) Elapsed time of 2 to 3 minutes if charges are prepared before hand.

**b. Demolition By Gunfire Or Grenades.**

- (1) Remove and empty fire extinguishers.
- (2) Puncture fuel tanks.
- (3) Fire on the equipment with artillery, rockets, 50 cal. machine guns, tanks or grenades, first at the engine and radiator, then the operator's compartment, and last at the rear of the tractor.
- (4) About 3 to 5 minutes of concentrated fire on this equipment should destroy it beyond use.

**c. Demolition By Sledge Hammer, Axes, Pick Axes, Crowbars, Or Any Other Heavy Tools Available.**

- (1) Remove and empty fire extinguishers.
- (2) Puncture fuel tanks.
- (3) Smash the engine cylinder head, cylinders, crankcase, carburetor, generator, magneto, air filters, oil filters, battery, water pump, injection pumps and valves, radiator, fuel pump and hydraulic pump.
- (4) Cut all cables and electric wiring.
- (5) If time permits, bury or scatter any or all of the pieces.
- (6) Smash all gears, clutches and cable drums.
- (7) Douse gasoline over tractor and ignite.
- (8) The time required will depend upon tools available.



## **PART THREE MAINTENANCE INSTRUCTIONS**

### **SECTION XI GENERAL**

#### **30. SCOPE.**

Part three contains information for the guidance of the using organizations responsible for the maintenance (1st and 2nd echelon) of this equipment. It contains information needed for the performance of the scheduled lubrication and preventive maintenance services as well as description of the major systems and units and their functions in relation to other components of the equipment.

### **SECTION XII SPECIAL ORGANIZATIONAL TOOLS AND EQUIPMENT**

#### **31. TOOLS ACCOMPANYING TRACTOR.**

A list of special tools accompanying the tractor is given in paragraph 6.

#### **32. SPECIAL SERVICE TOOLS.**

No special Caterpillar tools are issued to organizational mechanics.

### **SECTION XIII LUBRICATION**

#### **33. INTRODUCTION.**

Lubrication is a highly essential part of preventive maintenance, determining to a great extent the serviceability of parts and assemblies. Lubrication instructions for this tractor are consolidated in a lubrication order, (See figure 32.) which specifies the points to be lubricated, the periods of lubrication and the lubricant to be used. The lubrication points on the order are referenced to illustrations on the pages following the order. Paragraph 34 gives detailed instructions for some of the more complex lubrication operations.

# WAR DEPARTMENT LUBRICATION ORDER

WAR DEPARTMENT, WASHINGTON 25, D. C., 5 JULY 1944

## TRACTOR, CRAWLER, DIESEL, 70 TO 90-DBHP, STANDARD

(CATERPILLAR, MODEL D7) 74-IN. GAGE, WITH Le TOURNEAU WCK7 ANGLEDZOER, FTD7 and R7 POWER CONTROL UNITS

MFR'S. SERIAL No. located on left side rear Diesel engine, also rear of steering clutch case upper left corner

Reference TM 5-3070

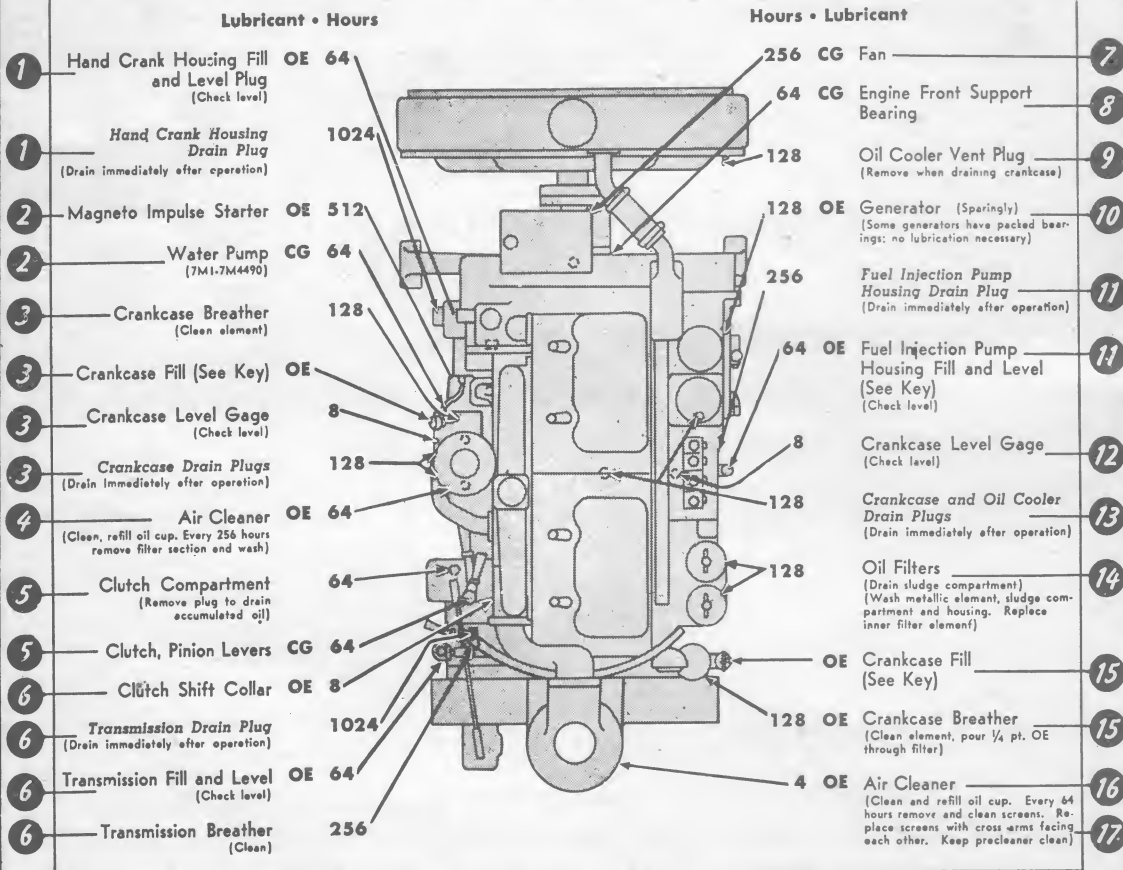
### KEY

LUBRICANT	CAPACITY	LOWEST EXPECTED AIR TEMPERATURE		
		Above +32°F.	+32°F. to 0°F.	Below 0°F.
OE—OIL, engine				
Diesel Crankcase	22 qt.	OE SAE 30	OE SAE 10	Every 32 hours drain crankcases, refill Diesel crankcase with 17 qts. OE-10 and Starting Engine crankcase with 1½ qts. OE-10. Mark new level on gage, then fill to normal level with 5 qts. gasoline (Diesel crankcase) and ½ qt. gasoline (Starting Engine Crank case.) Run engines 5 minutes to mix. Maintain to new level marks with OE-10 and to normal levels with gasoline. Drain, add ½ qt. OIL, fuel diesel then fill and maintain to level with OE-10.
Starting Engine Crankcase	2 qt.			
Fuel Injection Pump	1 qt.	OE SAE 30	OE SAE 10	
Starting Engine Transmission	½ qt.	OE SAE 50	OE SAE 30	GO Grade 75
Other Points		OE SAE 30	OE SAE 10	PS
CG—GREASE, general purpose		CG No. 1	CG No. 0	CG No. 0
PS—OIL, lubricating, preservative, special. (See OE)				

### STARTING ENGINE

NOTE—See Reverse Side for lubrication of TRACTOR

### DIESEL ENGINE



(See Order No. 1008A for lubrication of Angledozer and Power Control Units)

**NOTES**

1. FITTINGS—Clean before applying the lubricant gun
2. CLEANING—SOLVENT, dry cleaning, or OIL, fuel, diesel will be used to clean or wash all parts. Use of gasoline for this purpose is prohibited. All

3. HOURS—The hours indicated are for normal service. For extreme conditions of heat, water, dust and mud change crankcase oil and lubricate more frequently.

4. OIL CAN POINTS—Every 64 hours lubricate starting engine governor control linkage throttle control lever with OE.

5. POINTS REQUIRING NO LUBRICATION—Diesel Engine Water Pump, Starting Engine Magneto.

No. 1008 [NOT TO BE REPRODUCED in whole or in part without permission of the Office of the Chief of Engineers]

Requisition replacement orders from Maintenance Division, Military Supply, OCE, P. O. Box 1679, Columbus, Ohio.

Figure 32—(Sheet 1 of 2 sheets)—Lubrication order



# WAR DEPARTMENT LUBRICATION ORDER

WAR DEPARTMENT, WASHINGTON 25, D. C., 5 JULY 1944

## TRACTOR, CRAWLER, DIESEL, 70 TO 90-DBHP, STANDARD

(CATERPILLAR, MODEL D7) 74-IN. GAGE, WITH Le TOURNEAU WCK7 ANGLED OZER, FTD7 and R7 POWER CONTROL UNITS

TRACTOR SERIAL No. located on left side rear Diesel engine, also rear of steering clutch case upper left corner.

Reference TM 5-3070

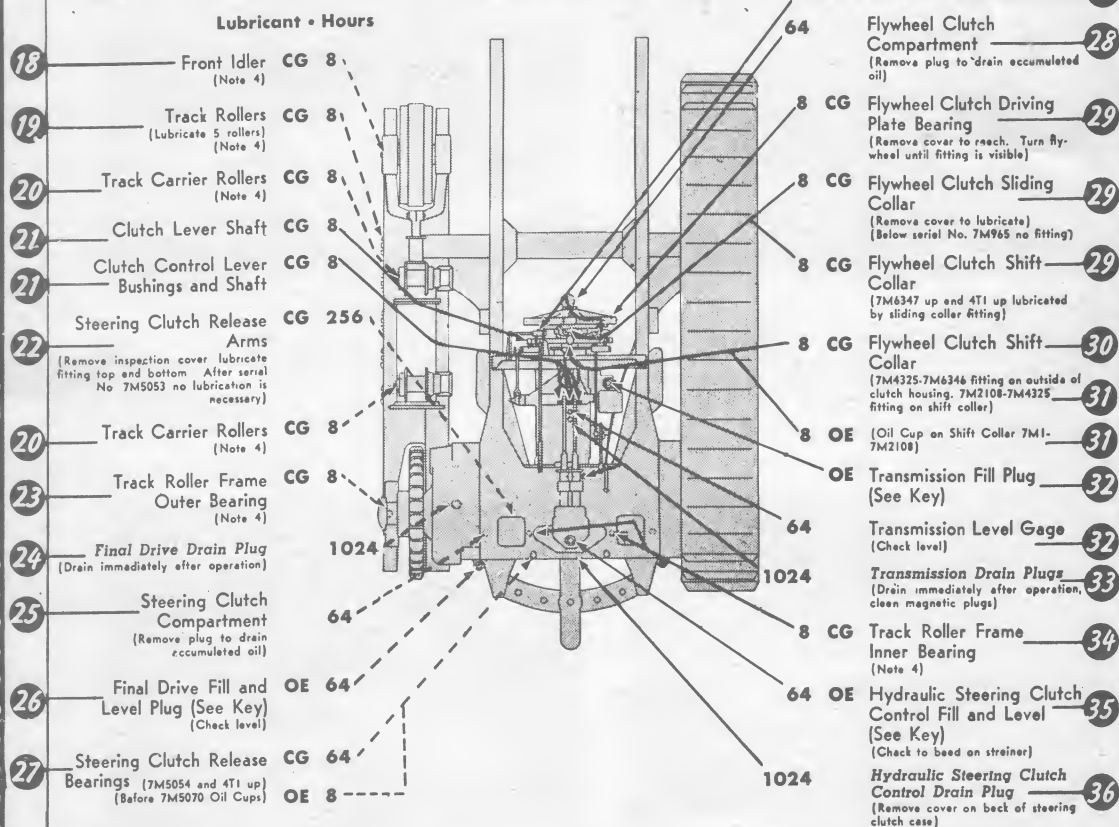
### — KEY —

LUBRICANT	CAPACITY	LOWEST EXPECTED AIR TEMPERATURE		
		Above +32°F.	+32°F. to 0°F.	Below 0°F.
OE—OIL, engine				
Hydraulic Steering Clutch Control	5 qt.	OE SAE 30	OE SAE 10	Insert suction gun in filler opening; pump out as much oil as possible and add PS to head on strainer. Maintain to level with PS.
Transmission	40 qt.	OE SAE 50	OE SAE 30	GO Grade 75
Final Drive (each unit)	24 qt.			
Other Points		OE SAE 30	OE SAE 10	PS
CG—GREASE, general purpose		CG No. 1	CG No. 0	CG No. 0
PS—OIL, lubricating, preservative, special. (See OE)				

**CAUTION** Lubricate Dotted Arrow Points on BOTH SIDES

**NOTE:** See Reverse Side for Lubrication of Starting and Diesel Engines

Hours • Lubricant



### NOTES

- FITTINGS—Clean before applying the lubricant gun.
- CLEANING—SOLVENT, dry cleaning, or OIL, fuel, diesel will be used to clean or wash all parts. Use of gasoline for this purpose is prohibited. All parts will be thoroughly dry before relubrication.
- HOURS—The hours indicated are for normal service. For extreme conditions of heat, water, dust and

mud, change crankcase oil and lubricate more frequently.

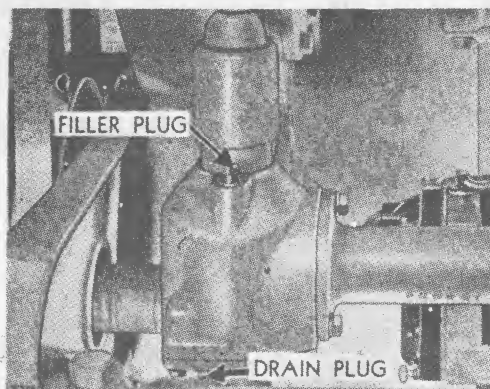
- MUD OR DEEP WATER OPERATION—Lubricate track rollers and idlers every 4 hours.
- OIL CAN POINTS—Every 64 hours lubricate brake and clutch linkage with OE.
- POINTS REQUIRING NO LUBRICATION—Tracks.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained therein are mandatory and supersede all conflicting lubrication instructions dated prior to 5 July 1944.

By order of the Secretary of War:  
G. C. MARSHALL,  
Official  
J. A. ULIO,  
Major General,  
The Adjutant General.

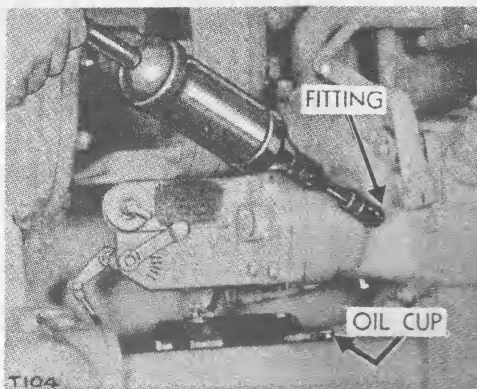
No. 1008 [NOT TO BE REPRODUCED in whole or in part without permission of the Office of the Chief of Engineers]

Figure 32—(Sheet 2 of 2 sheets)—Lubrication order



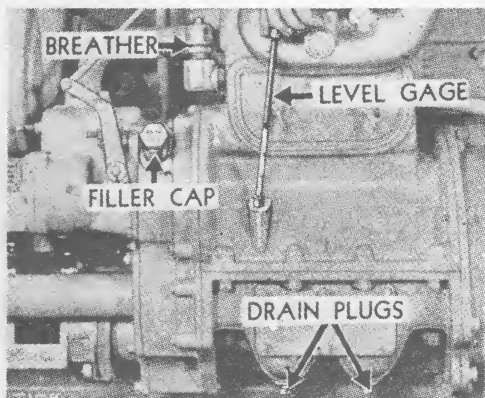
**REF. 1—HAND CRANK HOUSING—**

Filler or level, and drain plugs. Drain when oil is warm. Fill with oil to level of filler hole.



**REF. 2—WATER PUMP SHAFT—  
MAGNETO IMPULSE STARTER—**

Machines 7M1—7M4990 have water pump. Apply lubricant through fitting. Lubricate magneto impulse starter through one oiler. A few drops of oil is ample.



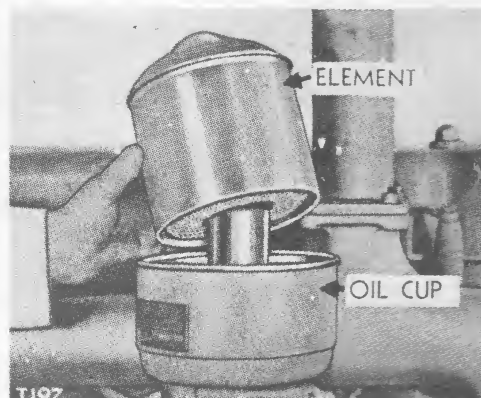
**REF. 3—CRANKCASE—**

Breather—remove and wash element at each oil change. For details see paragraph 34b.

Filler—remove cap and fill to level on gage.

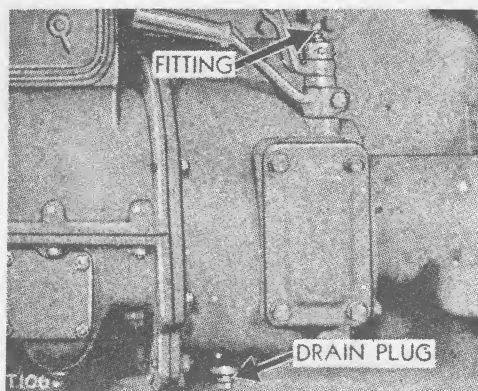
Level gage—remove gage, oil should be up to "Full" mark.

Drain—2 plugs, drain when oil is warm. Tighten plugs when installing.



**REF. 4—AIR CLEANER—**

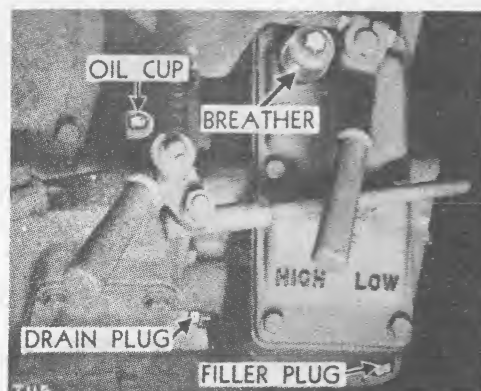
Remove cover and element. Wash and refill oil cup to level mark. Remove element and wash. For details see paragraph 34a.



**REF. 5—CLUTCH, CONTROLS—**

Clutch operates in dry compartment. Remove plug to drain accumulated oil. Install plug to keep out dirt and moisture.

Controls—one fitting. Apply lubricant through fitting.



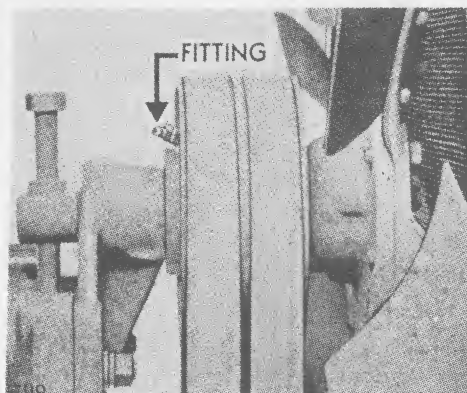
**REF. 6—CLUTCH— TRANSMISSION—**

Shift collar—one oiler. Apply lubricant through oiler.

Drain—Remove plug to drain.

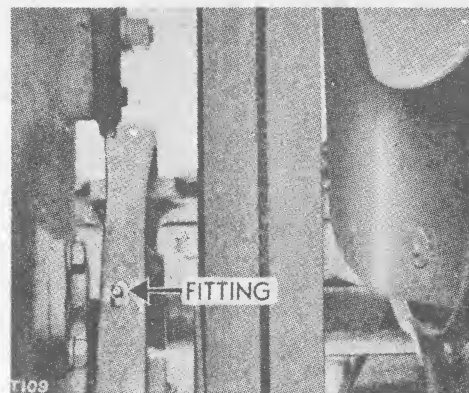
Fill and level plug—Keep lubricant to level of filler hole.

Breather—Remove element, clean in dry cleaning solvent.



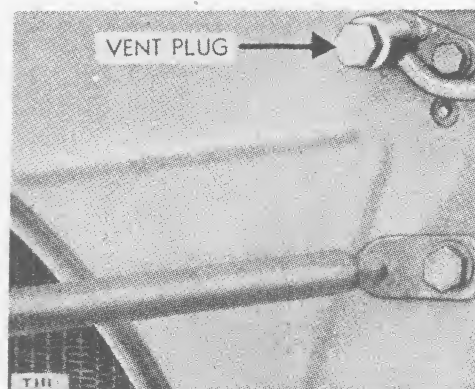
**REF. 7—FAN—**

One fitting. Apply two or three shots of lubricant through fitting, do not over lubricate.



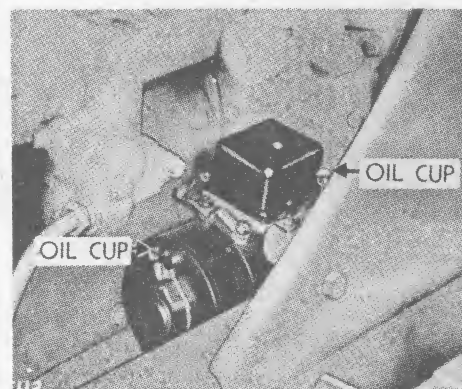
**REF. 8—ENGINE FRONT SUPPORT—**

One fitting. Apply lubricant through fitting until new grease appears.



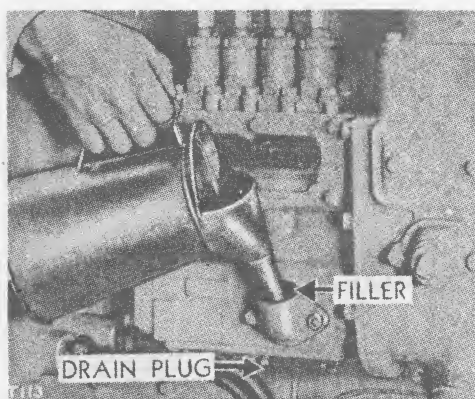
**REF. 9—OIL COOLER VENT**

Remove plug when draining crankcase. Install plug after draining.



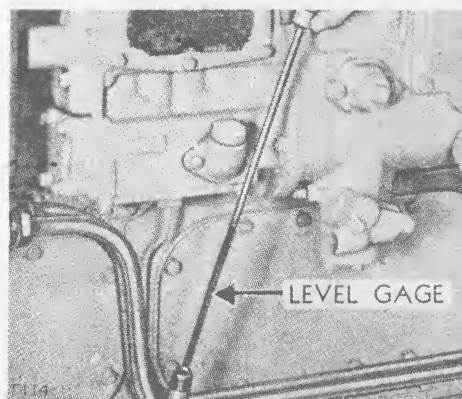
**REF. 10—GENERATOR—**

Two oilers. Apply two or three drops of oil. Some generators have packed bearings which need no other lubrication.



**REF. 11—FUEL INJECTION PUMP HOUSING**

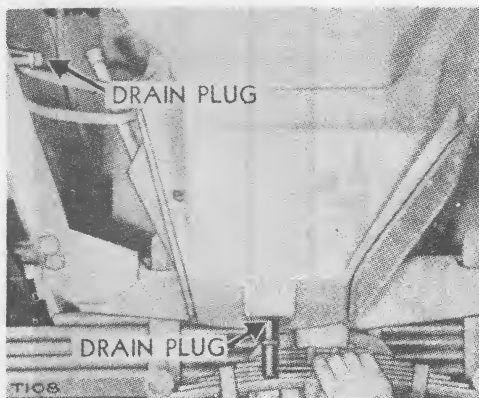
Fill and level cap, drain plug. Drain when oil is warm. Fill with oil to top of filler elbow.



**REF. 12—CRANKCASE LEVEL GAGE—**

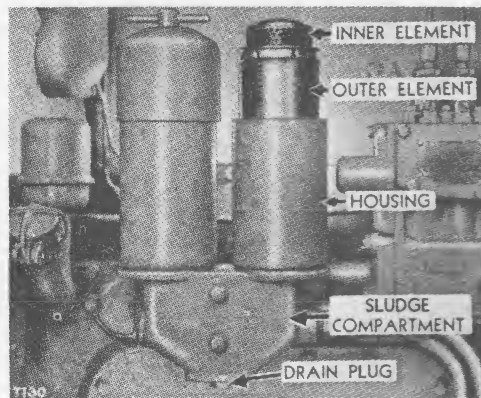
Remove gage and clean with wiping cloth. Install and again remove. Oil level should be up to "Full" mark. Check with engine running as guard around the gage assures accurate reading.





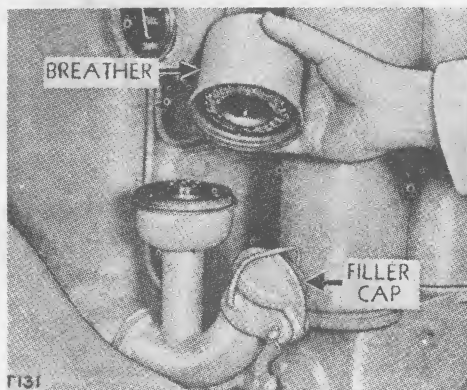
**REF. 13—CRANKCASE AND OIL COOLER DRAIN**

Two plugs. Drain when oil is warm, also remove vent plug. (See reference 9), tighten plugs when installing.



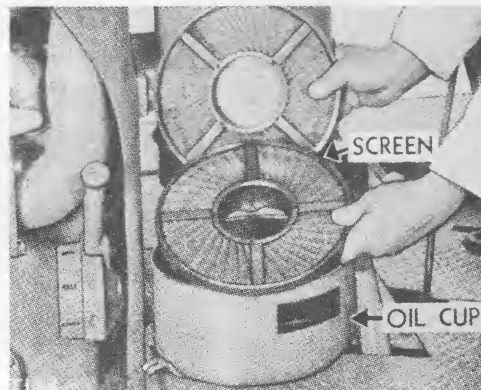
**REF. 14—OIL FILTERS**

Remove plug to drain sludge compartment. Remove cover, wash metallic elements, sludge compartment and housings with dry cleaning solvent. Install new inner filter element. For details see paragraph 73.



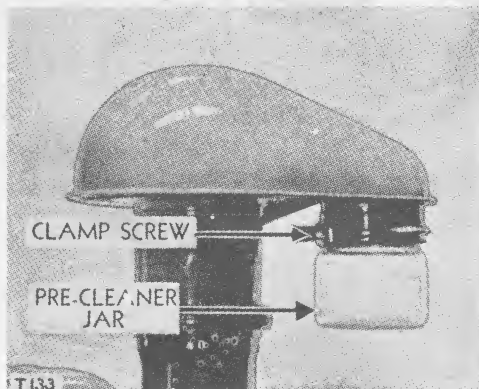
**REF. 15—CRANKCASE FILL AND BREATHER**

Remove filler cap and fill through filler pipe. Run engine a few minutes to fill oil coolers and filters. Refill crankcase to "Full" mark on level gage. Remove breather, wash, dry and oil.



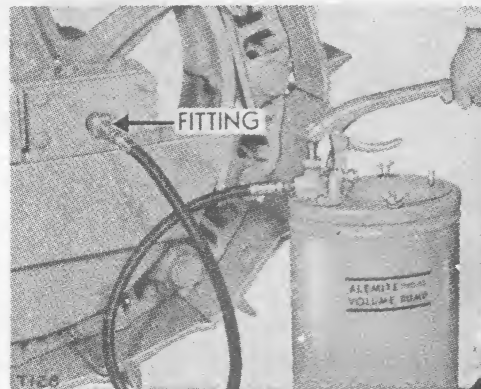
**REF. 16—AIR CLEANER—**

Service oil cup and screens. For details see paragraph 34a.



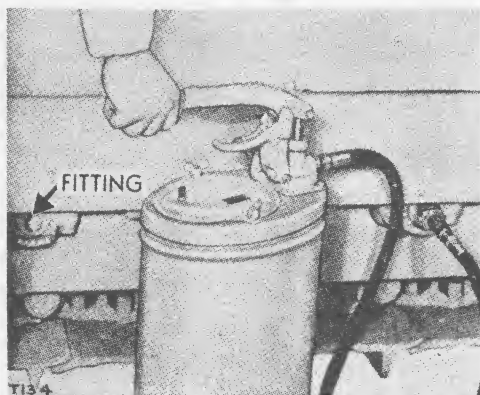
**REF. 17—PRECLEANER**

Remove and empty the glass jar before it becomes three-fourths full of dirt. **Caution:** Do not operate with jar removed or fill with oil or water, keep fins clean.



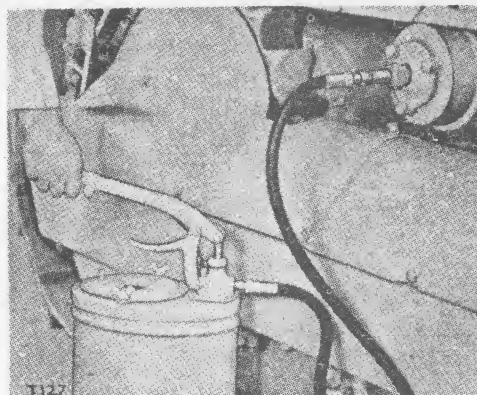
**REF. 18—FRONT IDLER—**

Two fittings (one on each side). Clean fittings. Pump in lubricant until a resistance is felt. **Caution:** Over lubrication may damage seals.



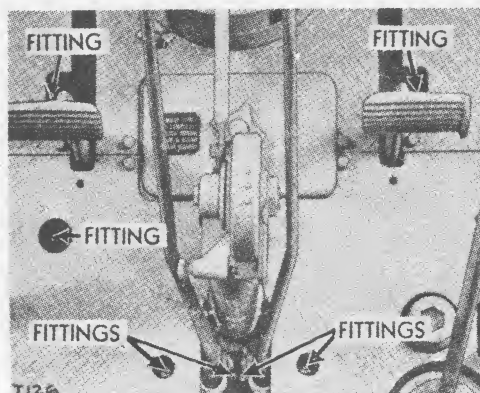
**REF. 19—TRACK ROLLERS—**

Ten fittings (five on each side). Clean fittings. Pump in lubricant until a resistance is felt. **Caution:** Over lubrication may damage seals.



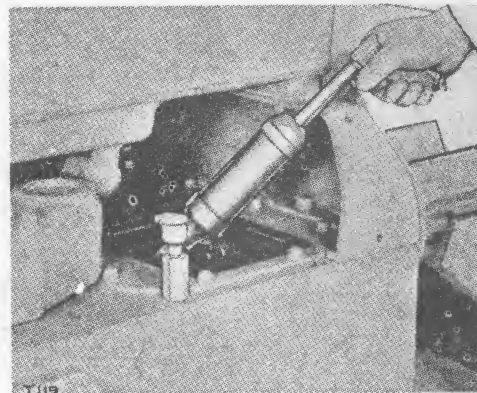
**REF. 20—TRACK CARRIER ROLLERS—**

Four fittings (two on each side). Clean fittings, apply lubricant through fitting.



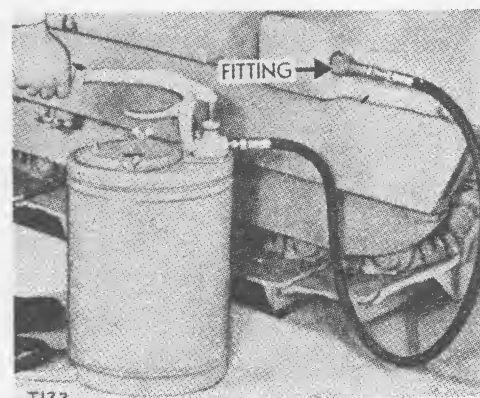
**REF. 21—BRAKE PEDAL SHAFTS, CLUTCH LEVER SHAFT, CLUTCH CONTROL LEVER BUSHINGS AND SHAFT—**

Seven fittings. Clean fittings. Apply lubricant through fittings until new grease appears.



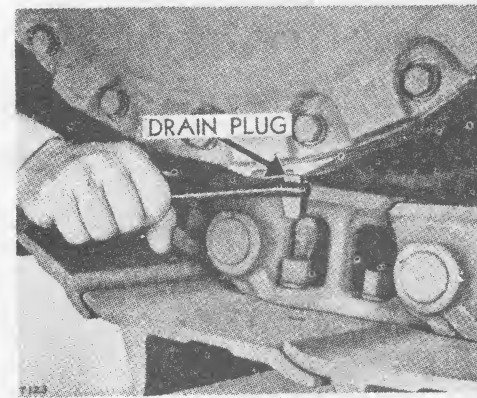
**REF. 22—STEERING CLUTCH RELEASE ARMS**

Remove inspection cover. Four fittings (two on each side, on machines 7M1-7M5053. After 7M5053 no lubrication is necessary.



**REF. 23—TRACK ROLLER FRAME OUTER BEARING—**

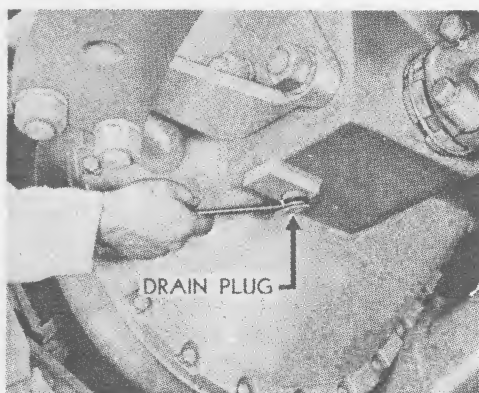
Two fittings (one on each side). Clean fittings before applying lubricant.



**REF. 24—FINAL DRIVE DRAIN**

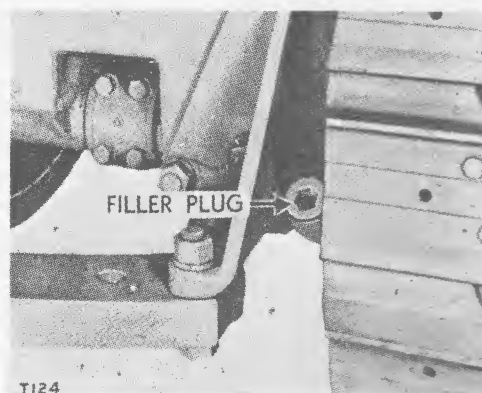
Two plugs (one on each side). Drain when lubricant is warm. When operating in deep mud and water, check daily for presence of water in lubricant.





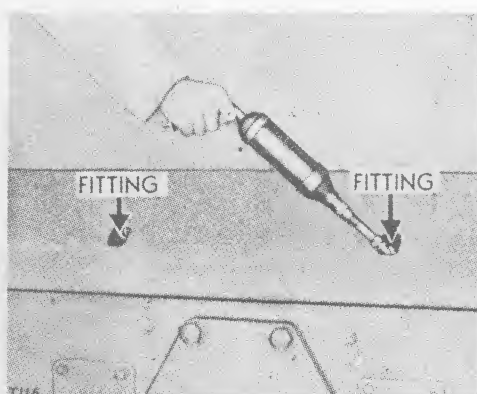
**REF. 25—STEERING CLUTCH COMPARTMENT**

Two plugs. The steering clutches operate in dry compartments. Remove plugs to drain any accumulated oil. Install plugs to keep out dirt and moisture.



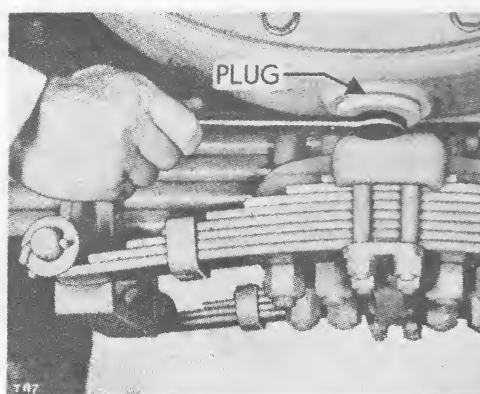
**REF. 26—FINAL DRIVE FILL AND LEVEL—**

Two plugs (one on each side). Remove plugs to check and fill, keep lubricant to level of filler hole.



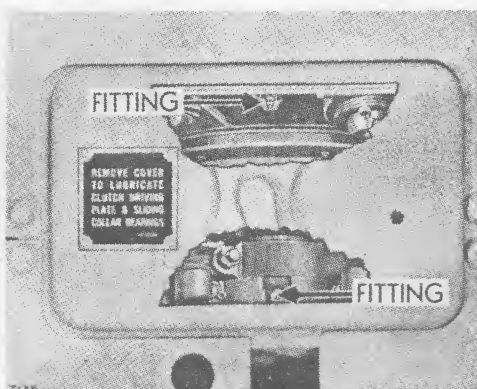
**REF. 27—STEERING CLUTCH RELEASE BEARING—**

Machines after 7M5054 have two fittings. Lubricate with pressure gun. Machines before 7M5054 have two oilers to be lubricated with O.E.



**REF. 28—FLYWHEEL CLUTCH COMPARTMENT**

Machines after 7M4325 flywheel clutch operates in a dry compartment. Remove plug to drain accumulated oil. Install plug to keep out dirt and moisture. Machines before 7M4325 have open type clutch.

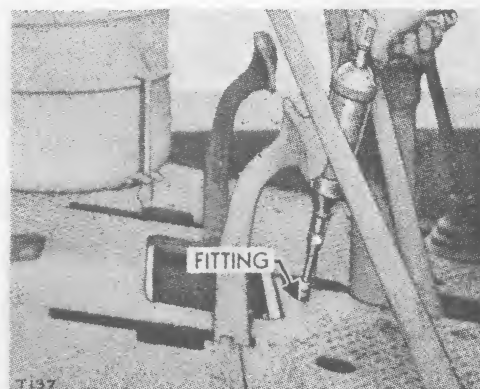


**REF. 29—FLYWHEEL CLUTCH—**

Driving plate bearing. Remove cover to reach. Turn flywheel until fitting is visible. Two or three shots of lubricant is ample.

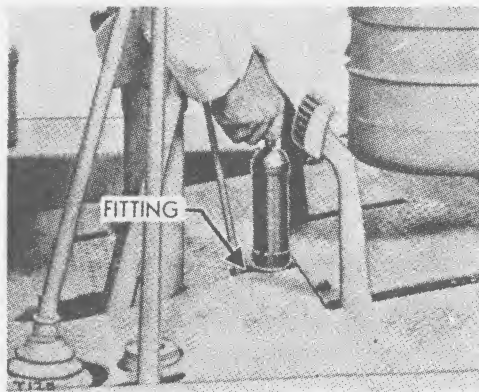
Sliding collar. To lubricate turn clutch until fitting is visible. Below serial 7M965 no fitting.

Shift collar. 7M6347 up and 4T1 up, lubricated by sliding collar fitting.



**REF. 30—FLYWHEEL CLUTCH SHIFT COLLAR**

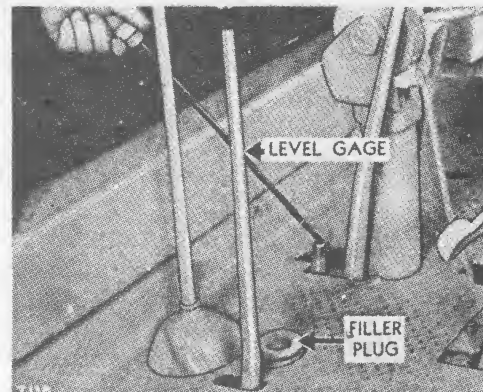
Serial 7M4325-7M6346. Lubricate through fitting on outside of clutch housing.



**REF. 31—FLYWHEEL CLUTCH SHIFT COLLAR**

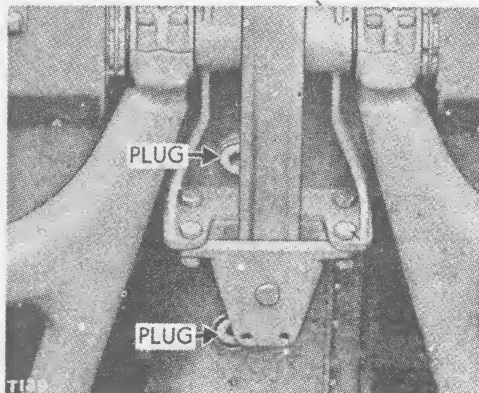
Serial 7M2108-7M4325. Lubricate through fitting on shift collar yoke.

Serial 7M1-7M2108. Lubricate through oil cup on shift collar yoke.



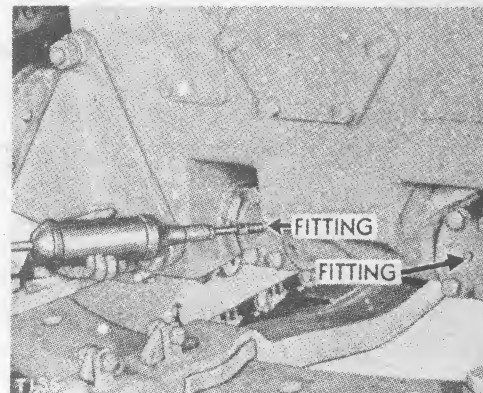
**REF. 32—TRANSMISSION—**

Fill plug and level gage. Fill to "Full" mark on level gage. Bevel gear compartment receives no oil unless initial level is to "Full" mark on gage.



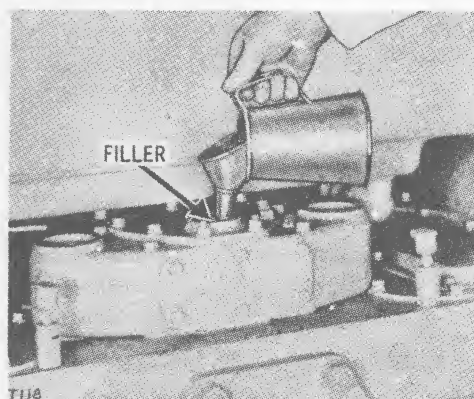
**REF. 33—TRANSMISSION DRAIN**

Two plugs. Drain when lubricant is warm. Clean magnet on plugs. Tighten plugs securely when installing.



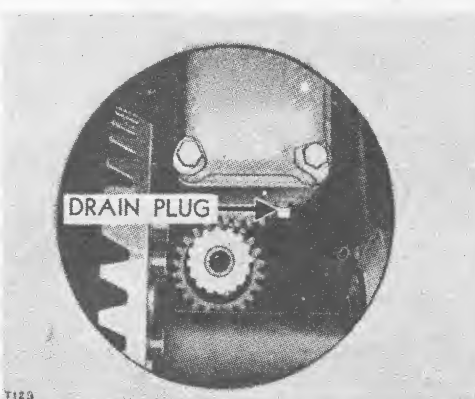
**REF. 34—TRACK ROLLER FRAME INNER BEARINGS**

Two fittings (one on each bearing). Apply lubricant through fitting until new grease appears.



**REF. 35—HYDRAULIC STEERING CLUTCH CONTROL—**

Fill and level plug. Fill to level of bead in strainer. Care should be taken to keep out dirt.



**REF. 36—HYDRAULIC STEERING CLUTCH CONTROL DRAIN**

Remove cover on back of steering clutch case. Drain housing the same time transmission is drained. NOTE: Four quarts of oil can be sucked out of filler opening.

### 34. DETAILED LUBRICATION INSTRUCTIONS.

#### a. Air Cleaners.

##### (1) STARTING ENGINE AIR CLEANER.

(a) AIR CLEANER CUP.—To change the oil in the air cleaner cup, unscrew the wing nut on top of the air cleaner and remove the filter section. Clean out the cup and refill with clean oil up to the oil level bead.

(b) FILTER.—The filter section can be cleaned by shaking it in a pan of dry cleaning solvent. Be sure there is a gasket between the air cleaner and its mounting as the connection must be air tight.

##### (2) DIESEL ENGINE AIR CLEANER.

(a) GENERAL.—The air cleaner does its work efficiently as long as the oil in the cup is thin enough to spray into the screen section and wash the dirt collected there back into the cup. When the oil becomes thickened with dust it is unable to do this. However, even in cold weather, the oil should not be too thin. Very thin oil can carry over into the intake manifold and carry dirt with it.

(b) PRE-CLEANER.—The pre-cleaner prevents the larger particles of dust from entering the air cleaner. It will function only when the glass jar is in place. Inspect the jar regularly and empty it when it is about half full of dust. The jar is removed by unscrewing the clamp that holds it in place. (On earlier tractors the jar is screwed in position on the pre-cleaner.) Inspect the fins in the pre-cleaner regularly and clean when dirty.

(c) AIR CLEANER INLET PIPE.—At the same time the oil in the cup is being changed, inspect the inlet pipe with the oil cup removed. Clean off any dirt that has collected on the walls of the pipe.

(d) AIR CLEANER SCREENS.—Six of the air cleaner screens can be removed for servicing. To remove the first screen, unscrew two wing nuts that hold it in place. The other screens will come off the air inlet pipe one at a time. If one of the screens is clean there is no reason for removing any above it. To wash the screens shake them in a pan of Diesel fuel or dry cleaning solvent. When replacing the screens arrange them in pairs with the cross arms facing each other. Be sure and tighten the wing nuts holding the screens to prevent them from vibrating and eventually disintegrating.

#### b. Breathers.

(1) GENERAL.—To insure a clean supply of air entering the crankcases, replaceable crimped copper filter elements are used. The elements can be removed for cleaning and should be washed in Diesel fuel or dry cleaning solvent. Before replacing the elements, soak the crimped copper with lubricating oil.

(2) **STARTING ENGINE CRANKCASE BREATHER.**—This breather can be unscrewed from the starting engine as a unit and then disassembled. The filter cover is held in place by a nut tightened on a stud. Remove the nut and take off the cover. The filter element can then be removed for cleaning.

(3) **DIESEL ENGINE CRANKCASE BREATHER.**—The breather is mounted on the crankcase oil filler assembly. The filter element fits in the cap assembly and can be removed by unscrewing the cap and prying the element out of the cap. After the cap has been removed the skirt assembly can be lifted off of the oil filler assembly and cleaned.

c. **Compartments Containing Oil.**—Mud, dust or water should be prevented from entering all compartments containing oil. Excessive leakage of oil from a compartment indicates seals or gaskets are defective and should be replaced to prevent the entrance of dirt and water. If dirt is detected in a compartment the oil should be changed immediately but the mechanism should be disassembled and cleaned at the first opportunity.

## SECTION XIV

### PREVENTIVE MAINTENANCE SERVICES

#### 35. GENERAL.

Preventive maintenance services as prescribed by Army Regulations are a function of using organization echelons of maintenance. These services consist generally of: before, during and after operation services, performed by the operator; the scheduled services weekly and monthly performed by organizational maintenance personnel.

#### 36. OPERATOR MAINTENANCE (1ST ECHELON).

a. The tractor operator is the most important single factor in preventive maintenance. Only through him can the mechanic know what difficulties a piece of equipment is giving.

b. The tractor operator should accompany their tractors and assist the mechanics while periodic second echelon preventive maintenance services are performed.

c. Each operator is required to perform certain daily maintenance services on his tractor as a matter of regular routine. The faithful performance of these services will do much to prolong the life of the tractor, avoid major repairs and assure the operator that his tractor will perform its missions consistently and dependably.



### 37. OPERATORS DAILY PREVENTIVE MAINTENANCE SERVICE.

The following preventive maintenance procedures are identical with those outlined on one side of the Preventive Maintenance Guide. Numbers 1-86 refer to W. D. Form No. 48. Numbers 87-97 are added services.

#### BEFORE OPERATION SERVICE.

**Purpose.**—To determine if condition of equipment has changed since last operated.

Item 1, **Tampering And Damage.**—Check for damage from falling debris, shell fire, sabotage, or collision.

Item 3, **Fuel, Oil And Water.**—Check fuel tanks—see that they are full. Check oil in engines and coolant in radiator. Do not fill radiator (when cold) to overflow—allow room for expansion.

Item 6, **Leaks, General.**—Check fuel, oil and water piping and connections for leaks.

Item 7, **Engine Warm Up.**—Start engine—be sure flywheel clutch is disengaged and speed selector lever is in neutral. After Diesel engine starts engage flywheel clutch and allow engine to warm up at a fast idling speed for at least 10 minutes before applying load. Do not race a cold engine. (See paragraph 15.)

Item 9, **Instruments.**—After engine warms up oil pressure gage should register in the "OPERATING RANGE". If gage fails to register, stop engine, see that trouble is corrected. The fuel pressure gage should register in "NORMAL" (white) range. (See paragraph 14.)

Item 12, **Lights.**—Check lights and switch see that they are in good condition.

Item 14, **Tracks.**—If freezing has occurred since last operation—see that tracks are free before moving machine.

Item 24-2d, **Lubrication.**—If steering clutch release bearing and master clutch shift and sliding collars are equipped with oil cups, lubricate them.

Item 21, **Tools And Equipment.**—Inspect reserve supplies of oil and lubricants—see that they are complete and emergency equipment, tools and spare parts are in good condition and in place. (See paragraphs 6 and 7.)

Item 22, **Engine Operation.**—Check engine for normal operation, and note any unusual sounds or unsatisfactory characteristics which would indicate trouble. Check instrument readings again and frequently during operation.

Item 24—2-e, **Clutches And Brakes.**—Test all clutches and brakes, see that they hold securely. (See paragraphs 80, 87 and 91.)



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Preventive Maintenance Services

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Item 24—2-c, **Attachments**.—See that brakes and clutches hold securely. Check blade and attachments for lost pins, loose bolts, or damage. When using hydraulic system check oil level in the reservoir—add oil if necessary. Test operation of the blade under all control settings.

**Engineer equipment is vital to the war effort. It is your duty to take care of it.** Remember —“Battles are won by machines that run.”

### DURING OPERATION SERVICES.

**General**.—This is an operator's responsibility—to detect deficiencies in operation, unusual sounds, odors or other signs of out of normal operation that would indicate trouble ahead if not corrected promptly. Report deficiencies that develop during operation, using form 48.

Item 26, **Steering Brakes**.—To test, try each brake separately, by releasing steering clutch and applying brake. The brake should hold track for proper steering when foot pedal is depressed approximately three-fourths of the way to the floor plate.

Item 28, **Steering Clutches**.—There should be approximately three inch free play at top of clutch levers.

Item 29, **Transmission**.—See that gear selector, and reverse and forward levers operate freely, and do not creep out of mesh.

Item 31, **Engine And Controls**.—Check engine in regards to power, unusual noise and response to controls.

Item 32, **Instruments**.—Check oil, fuel and temperature gages frequently. Stop at signs of failure—locate and correct trouble.

Item 34, **Running Gears**.—Listen for an unusual noise from tracks, sprockets, or rollers.

### AT HALT.

Item 38, **Fuel, Oil And Water**.—Check for adequate supply of fuel. Check crankcase oil level, add correct lubricant if necessary. Check coolant in radiator.

Item 46, **Leaks, General**.—Check for fuel, oil or water leaks. Trace any to their source and see that they are corrected.

Item 47, **Accessories And Belts**.—See that all accessories are in good condition and securely mounted. Check condition and adjustment of fan belt. (See paragraph 63.)

Item 48, **Air Cleaner**.—If operating in extremely dusty conditions remove air cleaner oil bowl, clean and refill with oil as required.

### AFTER OPERATION SERVICES.

The following daily after operation services are to be performed by the operator (or crew) immediately after the operation period and during continuous operations at eight hour intervals.

Item 54, **Fuel, Oil And Water.**—Clean fuel tank filler screen. Fill fuel tank. Check Diesel crankcase oil level, (with engine at idling speed), fill to full mark. Check level of coolant in radiator. The level should be at or near overflow when hot. Protect coolant from freezing in cold weather. Test anti-freeze value when using. If anti-freeze is added engine must be run to thoroughly mix solution. (See paragraph 22.)

Item 55, **Engine Operation.**—Check engine for proper operation, unusual sounds or unsatisfactory characteristics which would indicate trouble.

Item 56, **Instruments.**—See that they are securely mounted and properly connected.

Item 59, **Lights.**—Check lights. See that they function correctly.

Item 63, **Accessories And Fan Belts.**—Check carburetor, generator, fan, fuel and water pump for loose connections or proper mounting. Check fan belt for damage and adjustment. (See paragraph 63.)

Item 64, **Electric Wiring.**—Examine all wiring—see that connections are tight, wires clean and not damaged.

Item 65, **Air Cleaner.**—Remove Diesel air cleaner oil bowl—clean and refill with correct oil. Check starting engine air cleaner oil bowl. Add oil if necessary. (See paragraph 33.)

Item 67, **Engine Controls.**—Check for worn or disconnected linkage.

Item 73, **Leaks, General.**—Examine fuel and oil system piping for leaks and loose connections. Check water pump and radiator for leaks.

Item 88-g, **Final Drive Cases.**—Examine gasketed joints in final drive cases for leaks and loose cap screws. Keep cap screws tight. Check bolts in outer frame bearing housing. See that they are tight.

Item 88-a, **General.**—Inspect track and guides for worn, broken or loose parts. Clean mud, dirt or ice from all track parts, rollers, guides and sprockets.

Item 88-h, **Master Clutch.**—Check master clutch adjustment—the clutch lever should engage with a distinct snap. (See paragraph 80.)

Item 88-i, **Steering Clutches.**—Check steering clutch adjustment, about three inch free movement at top of clutch levers. (See paragraph 87.)

Item 88-j, **Steering Clutch Brakes.**—See that they will hold with foot pedal depressed  $\frac{3}{4}$  way to the floor plate. (See paragraph 91.)

Item 88-c, **Attachments.**—See that clutches and brakes perform properly. Check cables for wear or broken strands. Check gear case oil levels—add oil if required. With hydraulic system see that all pipe and hose connections are tight and do not leak. Check oil level in reservoir.

Item 83, **Lubrications.**—Lubricate all 8 hour points shown on the Lubrication Order. (See figure 32.)

Preventive Maintenance Services

Item 88-f, **Protection**.—Cover exhaust pipes when leaving or storing tractor outside. Place machine on firm level footing, if necessary use rock, brush, or planking. (Follow this closely in freezing weather.)

### 38. ORGANIZATIONAL MAINTENANCE (2ND ECHELON).

a. **General**.—The item numbers of the preventive maintenance procedures that follow are identical with those outlined in TM 37-2810 and the Preventive Maintenance Service and Technical Inspection Work Sheet form No. 464.

b. **Chart**.—The procedure for performing each item in the weekly and monthly maintenance services are described in the following chart and references are made to pertinent paragraphs in the manual. Each page of the chart has two columns at its left edge corresponding to the weekly and monthly maintenance. In order to determine which procedure to follow, look down the column corresponding to the maintenance due, and wherever an item number appears perform the operations indicated opposite the number.

#### 256 Hrs. 64 Hrs.

1 1 **Before Operation Services.** Check and perform services required in numbers 1-6-7-9-12-14 listed in Before Operation Services.

#### STARTING ENGINE

- |    |    |   |
|----|----|---|
| 28 | 28 | <b>Cylinder Head, Manifold &amp; Gasket.</b> —Check for cracks and leaks.   |
| 29 | 29 | <b>Crankcase, Breather.</b> —Drain and refill with OE when Diesel engine crankcase is serviced. Remove and wash breather and replace.   |
| 30 |    | <b>Valves.</b> —Check and adjust valve clearance (.008 inch) on D7 and D8. (See paragraph 51.)  |
| 31 | 31 | <b>Ignition System.</b> —See that wires are clean and not damaged. Remove and clean spark plugs — replace if broken or damaged. Adjust points to .022 inch. (See paragraph 49.)   |
| 32 | 32 | <b>Carburetor And Governor.</b> —See that they are securely mounted. Check carburetor and connections for leaks. Clean fuel sediment bowl. See that all linkage is in good condition and lubricate ball joint connections with OE. (See paragraph 50.)  |
| 26 | 26 | <b>Air Cleaner.</b> —Remove and wash filter section and replace. Clean oil bowl and refill with OE. (See paragraph 33.)   |
| 33 | 33 | <b>Clutch &amp; Transmission.</b> —Adjust clutch to engage with a distinct snap and a reasonably hard lever pull. See that clutch transmits power without slipping. Drain and refill transmission with correct lubricant at intervals specified on the lubrication order. (See paragraph 52.) |

#### DIESEL ENGINE

- |    |    |  |
|----|----|--|
| 16 | 16 | <b>Radiator.</b> —Clean core air passages. Check for leaks. Examine coolant. If contaminated with rust, oil, or other foreign matter flush and refill. Protect coolant from freezing in cold weather. Record value of antifreeze in space provided on work sheet. (See paragraph 61.)  |
| 17 | 17 | <b>Water Pump, Fan &amp; Shroud.</b> —Check pump for leaks. On D7 and D8 adjust packing nut until leak stops and then back nut off 1/6th turn to avoid binding on shaft. (D4 and D6 are not adjustable.) See that fan blades are in good condition and properly aligned and that shroud is securely mounted. (See paragraphs 62 and 63.) |
| 18 | 18 | <b>Belts.</b> —Check fan belt for tension (1 inch slack on D4 and D6. 1½ inch on D7 and D8.) Keep the adjustment locking device tight. Replace belt if badly worn. (See paragraph 63.)   |

256 Hrs. 64 Hrs.

- |    |    |  |
|----|----|--|
| 11 | 11 | <b>Cylinder Head &amp; Gasket.</b> — Check for cracks and leaks. On new or reconditioned engines tighten stud nuts on cylinder head at the first 64 hour check. Valve clearance adjustment must be made after tightening head bolts. (See paragraph 58.)   |
| 12 |    | <b>Valves.</b> — Check valve clearance (.010 inch on D4 and D6. .012 inch on D7 and D8 while engine is hot). Make adjustment if necessary. On D7 and D8 check and adjust clearance between compression release rods and valve rockers (.025 to .030) when valves are adjusted. (See paragraph 59.)             |
| 14 | 14 | <b>Crankcase Breather.</b> — Drain crankcase and refill with correct lubricant at intervals specified on lubrication order. Perform this service while engine is warm. Remove and wash breather element at each oil change. Lubricate element with about ¼ pint OE and replace. (See paragraph 33.)            |
| 15 | 15 | <b>Oil Filter.</b> — When crankcase oil is changed drain the filter housing. Remove the elements. Thoroughly wash the covers, outer elements and compartments, with fuel oil or solvent. Renew the inner element. (See paragraph 33.)  |
| 43 | 43 | <b>Fuel Tank, Filter Element, Cap &amp; Gasket.</b> — Check for leaks. Open drain cock under tank and drain sediment and water. Remove and wash filler cap and filter element—pour a small amount of OE on element and replace. See that cap fits securely and vent hole is open. (See paragraph 66.)          |
| 41 | 41 | <b>Air Cleaner &amp; Precleaner.</b> — Remove oil bowl and six removable screens. Wash bowl and screens thoroughly in fuel oil or solvent. Replace screens. Refill bowl to proper level with OE and replace. See that all connections are tight. Remove precleaner jar, clean and replace. (See paragraph 33.) |
| 38 | 38 | <b>Fuel Injection Pump And Housing.</b> — See that all mounting bolts are tight and connections don't leak. Check oil level in housing—fill to top of filler elbow.  |
| 38 |    | Drain fuel injection pump housing and refill as specified on the lubrication order. (See paragraph 33.)  |
| 42 | 42 | <b>Fuel Injection Valves.</b> — Check lines for leaks. (If engine runs irregularly or the exhaust shows an excessive amount of smoke, the injection valves should be tested.) To test: (See paragraph 70.)   |
| 40 | 40 | <b>Diesel Fuel Filter.</b> — Drain sediment and water from filter housing. To drain: Close main fuel tank valve. Open upper and lower vents in filter housing and remove drain plug. Allow housing to drain thoroughly. Replace plug and prime the fuel system. To prime: (See paragraph 69.)                  |
| 40 | 40 | If the fuel pressure gage indicator drops below the operating (white) range when engine is at operating speed, renew the filter elements. To renew: (See paragraph 68.)  |
| 43 |    | <b>Generator.</b> — Check generator commutator and brushes for wear or surplus oil deposit. Clean commutator with No. 00 sandpaper if necessary. Replace brushes if badly worn. Be sure new brushes seat properly with the contour of the commutator by using No. 00 sandpaper. (See paragraph 77.)            |
| 52 | 52 | <b>Lights.</b> — Examine all wiring, see that connections are right, wires clean and not damaged. Test switch and lights, see that they are securely mounted.  |

## POWER TRANSMISSION AND CRAWLER ASSEMBLIES

- |    |    |  |
|----|----|--|
| 93 | 93 | <b>Transmission.</b> —Check oil level—fill to full mark. NOTE: If oil shows signs of mud or water, drain transmission (while warm), see paragraph 33. Clean drain plugs and replace. Refill case to full with correct lubricant. |
| 95 | 95 | <b>Master Clutch.</b> — Adjust clutch to engage with a distinct snap and a reasonably hard level pull. To adjust: (See paragraph 80.)  |

## Preventive Maintenance Services

## 256 Hrs. 64 Hrs.

- |     |     |   |
|-----|-----|---|
| 95  | 95  | Remove drain plug in clutch housing and allow oil or seepage to drain. (Except D8) Replace plug.  |
| 96  | 96  | <b>Steering Clutches.</b> —Check control adjustment (approximately 3 inches of free movement at top of steering clutch lever). To adjust: (See paragraph 87.)   |
| 96  | 96  | Remove drain plug in steering clutch housings and allow oil and seepage to drain. Replace plug. On D6 and D7 remove filler plug from hydraulic steering clutch control housing and check oil level. Level should be at bead in strainer. Add oil if necessary. Exercise care to keep all dirt excluded. (See paragraph 33.) |
| 101 | 101 | <b>Steering Brakes.</b> —Adjust brakes so they will hold with foot pedal depressed $\frac{3}{4}$ way to the floorplate. The bands should be entirely free when in release position. Inspect bands for wear—replace before lining is worn flush with rivets. (See paragraph 91.)   |
| 107 | 107 | <b>Final Drive.</b> —Check seals and gaskets for leaks. See that all bolts at the housing connections are tight. Check oil level in the cases—fill to the filler plug elbow with correct lubricant. If oil shows signs of mud or water, drain and refill. (See paragraph 34c(3).)   |
| 94  | 94  | <b>Drive Sprockets.</b> —Check drive sprocket bearing adjustment—insert bar between sprocket and final drive case, if sprocket moves in and out, bearing needs tightening.  |
| 88  | 88  | <b>Idlers &amp; Rollers.</b> —See that they are in good condition, and being properly lubricated. (See paragraph 33.)   |
| 87  | 87  | <b>Track Assembly.</b> —Check track adjustment. The adjustment is correct when the track may be raised from $1\frac{1}{2}$ to 2 inches above the carrier roller with use of bar. Check all bolts and mountings. See that they are tight. (See paragraph 96.)  |

## ATTACHMENTS

(For details see applicable technical manual in the list of references, paragraph 106.)

- |     |     |   |
|-----|-----|---|
| 67  | 67  | <b>Power Control Unit.</b> —LeTourneau: Check clutches and brakes for wear and adjustment—replace lining if worn flush with rivets. See that all mounting bolts and capscrews are tight and that seals and gaskets do not leak. Replace cables if badly worn or strands broken. Check lubricant in gear cases—add correct lubricant if necessary.                                     |
| 67  |     | Check clutch, brake and sheave bearings. Adjustment is necessary if end play is detected.   |
| 67  | 67  | LaPlant-Choate Hydraulic. Remove and wash oil reservoir filler cap and breather—check oil level (5 inches below top of tank)—add OE if necessary. Check tank, valves, jacks and lines for leaks. See that cylinder head bolts on jacks are tight, and that all units are securely mounted.  |
| 135 | 135 | <b>Hyster Winch.</b> —Check brake band adjustment. The brake should hold securely when engaged and be entirely free of drum when released. Replace band if worn flush with rivets. See that the unit is securely mounted and that gasketed joints do not leak. Check gear case oil level, add correct lubricant if necessary. Drain and refill as specified in the lubrication order. |

## DOZER

(For details see applicable technical manual in the list of references, paragraph 106.)

- |     |     |   |
|-----|-----|---|
| 124 | 124 | <b>Cutting Edges.</b> —Reverse or replace if badly worn. Replace if broken. |
| 165 | 165 | <b>Frame, Yoke</b>  |
| 166 | 166 | <b>Moldboard.</b>   |
| 167 | 167 | <b>Lift Arms.</b>   |
| 168 | 168 | <b>Side Arms.</b>   |
- } Check for cracks and broken welds—correct deficiencies at once. See that all pins and couplings are in good condition and that all assemblies are securely mounted.



256 Hrs. 64 Hrs.

## GENERAL

- |   |   |  |
|---|---|--|
| 2 | 2 | <b>Lubrication.</b> —Perform all lubrication services as required by the Lubrication Order at the time of inspection. Make sure all fittings are clean and all bearings are taking grease. |
| 3 | 3 | <b>Tools.</b> —Check and clean all tools. See that they are properly stowed. (See paragraph 6.)  |
| 5 | 5 | <b>Publications.</b> —See that Technical Manuals, Preventive Maintenance Services, Lubrication Order, Form 478 and Form 26 are on the machine.   |
| 6 | 6 | <b>Appearance.</b> —Inspect machine for condition of paint, markings, damage, and general appearance.  |
| 7 | 7 | <b>Modification.</b> —See that all available modification work orders, applying to this machine, have been completed and recorded on Form 478.   |

NOTE 1. Preventive maintenance services are so important that they should be performed as a matter of regular routine, and never be entirely omitted, even in extreme tactical situations.

NOTE 2. Storage of Engineer Equipment. Process according to TM 5-9715.

## SECTION XV TROUBLE SHOOTING GUIDE

### 39. STARTING ENGINE.

#### a. Starting Engine Will Not Start.

Possible Cause	Possible Remedy
(1) Lack of gasoline in tank	Fill tank
(2) Water in gasoline or gasoline of improper quality	Drain and refill with good gasoline
(3) Gasoline not reaching carburetor	
(a) Gasoline shut off at tank	Turn valve "ON" under gasoline tank
(b) Clogged vent in filler cap	Remove dirt from hole in cap
(c) Dirt or ice in sediment bowl	Remove and clean
(d) Clogged filter within sediment bowl	Remove and wash (See paragraph 50.)
(e) Clogged gasoline line	Remove and clean
(f) Clogged screen at carburetor inlet	Remove and wash (See paragraph 50.)
(4) Flooded engine	Turn gasoline off at tank, push choke in, turn switch off and crank with governor control in high speed position, four or five revolutions then turn switch on and start
(a) Improper use of choke	(See paragraph 12b.)
(b) Float and valve in carburetor not functioning	Report to proper authority
(c) Dirty starting engine air cleaner	Service air cleaner (See paragraph 34.)
(5) Broken or corroded spark plug wires	Repair or replace
(6) Defective spark plugs	Clean, adjust or replace (See paragraph 49.)
(a) <b>Test.</b> —Remove plugs, ground them to engine and check spark while cranking	

# Trouble Shooting Guide

- |  |  |
|--|--|
| (7) Grounded switch  |  |
| (a) <b>Test.</b> —Remove wire from magneto and try to start engine. If engine starts switch is defective       | Replace                                    |
| (8) Wet ignition system  | Dry off system                             |
| (9) Faulty magneto   | Repair or replace (See paragraph 49.)      |
| (a) <b>Test.</b> —Remove wire from spark plug, hold it 1/8 inch from metal of spark plug crank and check spark |  |
| (10) Lack of compression   |  |
| (a) Oil washed from cylinder walls by flooded engine   | Remove spark plugs and put oil in cylinder |
| (b) Worn or broken piston rings  | Report to proper authority                 |

## b. Starting Engine Backfires.

- | Possible Cause                | Possible Remedy                  |
|-------------------------------|----------------------------------|
| (1) Crossed spark plug wires  | Attach in correct position       |
| (2) Magneto timing off        | Time magneto (See paragraph 49.) |
| (3) Cracked distributor plate | Replace plate                    |

## c. Starter Pinion Will Not Stay Engaged.

- | Possible Cause                                       | Possible Remedy  |
|--|--|
| (1) Diesel engine not sufficiently warm              | Let starting engine crank Diesel a longer period of time |
| (2) Diesel engine throttle open or throttle rod bent | Close throttle or straighten rod                         |
| (3) Starting engine running too fast                 | Report to proper authority                               |
| (4) Improper adjustment of latches                   | Adjust (See paragraph 53.)                               |
| (5) Worn or broken latches                           | Report to proper authority                               |

## d. Starter Pinion Will Not Release.

- | Possible Cause                           | Possible Remedy   |
|--|---|
| (1) Dirt, gum and corrosion in mechanism | Clean and wash with Diesel fuel or dry cleaning solvent             |
| (2) Diesel engine running too slow       | Open throttle 1/2 way back when starting Diesel (See paragraph 15.) |
| (3) Improper adjustment of latches       | Adjust (See paragraph 53.)  |
| (4) Broken release spring                | Report to proper authority  |

## e. Starting Engine Clutch Slips.

- | Possible Cause            | Possible Remedy                                   |
|---------------------------|---|
| (1) Improper adjustment   | Adjust (See paragraph 52.)                        |
| (2) Oil on clutch facings | Drain compartment and flush with cleaning solvent |
| (3) Facings worn out      | Report to proper authority                        |

## f. Starting Engine Has Not Enough Power To Rotate Diesel.

- | Possible Cause                                   | Possible Remedy            |
|--|----------------------------|
| (1) Transmission and flywheel clutch engaged     | Disengage flywheel clutch  |
| (2) Oil in Diesel engine crankcase too stiff     | (See paragraph 33.)        |
| (3) Starting engine in poor mechanical condition | Report to proper authority |

## 40. DIESEL ENGINE.

### a. Diesel Engine Will Not Start.

Possible Cause	Possible Remedy
(1) Diesel engine not sufficiently warm	Let starting engine crank Diesel for a longer period of time
(2) Lack of fuel in tank	Fill tank
(3) Fuel line shut off at tank	Open valve under tank and prime system (See paragraph 69.)
(4) Fuel system air locked	Prime system (See paragraph 69.)
(5) Clogged or mashed main fuel line	Clean, repair or replace and prime fuel system
(6) Slide bar sticking in shut off position	Remove plate from side of fuel pump housing, remove dirt and corrosion to free slide bar
(7) Fuel transfer pump failure	Clean bypass valve (See paragraph 67.) Replace pump (See paragraph 67.)
(8) Clogged air cleaner or blocked manifold	Service air cleaner Check manifold (See paragraph 34.)
(9) Poor compression	Report to proper authority
(10) Badly worn injection pumps	Check and replace if necessary (See paragraph 71.)

### b. Diesel Engine Knocks Excessively.

Possible Cause	Possible Remedy
(1) Poor grade of fuel	Improve quality of fuel
(2) Faulty injection valve	Test and replace if necessary (See paragraph 70.)
(3) Clogged air cleaner	Service air cleaner (See paragraph 34.)
(4) Loose connecting rod bearings	Report to proper authority
(5) Loose main bearings	Report to proper authority
(6) Piston hitting exhaust or inlet valve	Adjust valves (See paragraph 59.)

### c. Diesel Engine Smokes.

Possible Cause	Possible Remedy
(1) Clogged air cleaner	Service air cleaner (See paragraph 34.)
(2) Faulty injection valves	Test and replace if necessary (See paragraph 70.)
(3) Altitude	None (See paragraph 27.)
(4) Oil entering combustion chamber from crankcase	Report to proper authority
(5) Poor grade of fuel	Improve quality of fuel

### d. Diesel Engine Misses.

Possible Cause	Possible Remedy
(1) Air in fuel system	Prime system (See paragraph 69.)
(2) Faulty injection valves	Test and replace if necessary (See paragraph 70.)
(3) Clogged fuel filters	Check and replace (See paragraph 68.)
(a) <b>Symptom.</b> —A low fuel pressure gage reading	
(4) Defective transfer pump	Remove, clean or replace (See paragraph 67.)
(a) Dirt under bypass valve	Replace fuel transfer pump (See paragraph 67.)
(b) Worn pump gears (gradual drop in pressure)	

## Trouble Shooting Guide

- |   |   |
|---|---|
| <p>(5) Water in fuel</p> <p>(6) Defective inlet or exhaust valves</p> <p style="padding-left: 20px;">(a) Improper adjustment</p> <p style="padding-left: 20px;">(b) Improper adjustment of compression release push rods</p> <p style="padding-left: 20px;">(c) Broken valve spring</p> <p style="padding-left: 20px;">(d) Burnt or sticking valves</p> | <p>Drain and refill with clean fuel and prime system (See paragraph 69.)</p> <p>Adjust (See paragraph 59.)</p> <p>Make adjustment (See paragraph 59.)</p> <p>Report to proper authority</p> <p>Report to proper authority</p> |
|---|---|

### e. Lack of Power.

- | Possible Cause                                     | Possible Remedy                                    |
|--|--|
| (1) Clogged or tight tracks                        | Clean and loosen tracks, if necessary              |
| (2) Clogged air cleaner                            | Service air cleaner (See paragraph 34.)            |
| (3) Worn injection pumps                           | Check and replace if necessary (See paragraph 71.) |
| (4) Poor compression                               | Report to proper authority                         |
| (a) Worn piston rings                              | Adjust valves (See paragraph 59.)                  |
| (b) Improper adjustment of exhaust or inlet valves |  |
| (5) Altitude                                       | None (See paragraph 27.)                           |

### f. Diesel Engine Overheats.

- | Possible Cause   | Possible Remedy                       |
|--|---------------------------------------|
| (1) Insufficient coolant                                   | Check and fill                        |
| (2) Dirt and trash on oil cooler and between radiator fins | Clean out the dirt and debris.        |
| (3) Loose or broken fan belt                               | Adjust or replace (See paragraph 63.) |
| (4) Failure of water temperature regulator to open         | Report to proper authority            |
| (5) Excessive scale or sediment deposits in system         | Clean and refill (See paragraph 61.)  |
| (6) Water pump impeller loose on shaft                     | Report to proper authority            |

### g. Low Or No Oil Pressure.

- | Possible Cause                              | Possible Remedy                         |
|---|---|
| (1) Low or no oil in crankcase              | Check and fill to full mark             |
| (2) Clogged oil filters                     | Service oil filters (See paragraph 33.) |
| (3) Defective oil gage                      | Check and replace                       |
| (4) Clogged or broken line to gage          | Clean, repair or replace                |
| (5) Oil pump failure                        | Report to proper authority              |
| (6) Leak in oil cooler lines or connections | Repair or replace                       |
| (7) Loose connecting rod or main bearings   | Report to proper authority              |

## 41. FLYWHEEL CLUTCH.

### a. Flywheel Clutch Slips.

- | Possible Cause            | Possible Remedy                                       |
|---------------------------|---|
| (1) Improper adjustment   | Adjust (See paragraph 80.)                            |
| (2) Glazed clutch facings | Report to proper authority                            |
| (3) Oil on facings        | Drain compartment and flush with dry cleaning solvent |
| (4) Facings worn out      | Report to proper authority                            |

**b. Flywheel Clutch Will Not Stay Engaged.**

Possible Cause	Possible Remedy
(1) Improper adjustment	Adjust (See paragraph 80.)
(2) Dirt between release collar and adjusting collar which prevents "snap over center"	Clean and wash with dry cleaning solvent or Diesel fuel
(3) Worn clutch links, pins, cams and linkage	Report to proper authority
(4) Worn release collar	Report to proper authority

**c. Flywheel Clutch Will Not Disengage.**

Possible Cause	Possible Remedy
(1) No clearance between driving plate and pressure or driven plate	Locate the driving plate between the pressure and driven plates by shifting the washers on the flywheel studs
(2) Broken facing or rivets which let facing wedge between plates	Report to proper authority
(3) Drive plate bearing seized to clutch shaft	Report to proper authority

**42. TRANSMISSION.**

**a. Transmission Will Not Stay Engaged.**

Possible Cause	Possible Remedy
(1) Gears partially engaged	Fully engage gears
(2) Pin out of interlock linkage	Put in pin
(3) Improper adjustment of interlock linkage	Adjust (See paragraph 84.)
(4) Sticking interlock shaft or plungers	Clean and wash with dry cleaning solvent

**b. Transmission Will Not Engage Any Or All Gears.**

Possible Cause	Possible Remedy
(1) Interlock mechanism failure (a) Linkage disconnected (b) Linkage improperly adjusted	Connect linkage Adjust (See paragraph 84.)
(2) Bent or broken shifter fork	Report to proper authority

**c. Transmission Becomes Locked.**

Possible Cause	Possible Remedy
(1) A chip of metal between gears	Report to proper authority
(2) Shifter fork bent or broken	Report to proper authority
(3) Bent or broken shaft	Report to proper authority

**d. Transmission Makes Excessive Noise.**

Possible Cause	Possible Remedy
(1) Insufficient lubricant	Fill to oil level (See paragraph 33.)
(2) Worn or broken parts in transmission	Report to proper authority

**43. STEERING CLUTCHES.**

**a. Steering Clutches Hard To Disengage.**

Possible Cause	Possible Remedy
(1) Low or no oil in hydraulic control unit	Check oil level and add if necessary



# Trouble Shooting Guide

- |  |  |
|--|--|
| (2) Oil of incorrect viscosity in hydraulic control unit | Drain and refill with proper oil (See paragraph 33.) |
| (3) Broken or worn parts in hydraulic control unit       | Report to proper authority                           |

## b. Steering Clutches Slip.

- | Possible Cause  | Possible Remedy                       |
|---|---------------------------------------|
| (1) Dirt or trash between control lever and bumper block preventing the clutch from engaging properly | Remove dirt and debris.               |
| (2) Improper adjustments  | Make adjustment (See paragraph 87.)   |
| (3) Oil on facings  | Drain compartment (See paragraph 33.) |
| (4) Facings worn out  | Report to proper authority            |

## c. Steering Clutches Will Not Disengage.

- | Possible Cause                      | Possible Remedy            |
|-------------------------------------|----------------------------|
| (1) Improper adjustment             | Adjust (See paragraph 87.) |
| (2) Worn or damaged release bearing | Report to proper authority |

# 44. STEERING CLUTCH BRAKES.

## a. Brake Will Not Engage.

- | Possible Cause          | Possible Remedy |
|-------------------------|-----------------|
| (1) Pins out of linkage | Put in pins     |

## b. Brake Pedal Will Not Return.

- | Possible Cause                                     | Possible Remedy                              |
|--|--|
| (1) Hand operated lock on right brake pedal locked | Put lock in "OFF" position                   |
| (2) Brake return spring disconnected               | Connect spring                               |
| (3) Brake return spring weak or broken             | Replace spring                               |
| (4) Brake shaft sticking in steering clutch case   | Free shaft with dry cleaning solvent and oil |

## c. Brakes Slip.

- | Possible Cause                               | Possible Remedy   |
|--|---|
| (1) Improper adjustment                      | Adjust (See paragraph 91.)                                  |
| (2) Steering clutch not disengaging properly | Check steering clutch, adjust or repair (See paragraph 87.) |
| (3) Oil on brake lining                      | Drain compartment (See paragraph 33.)                       |
| (4) Worn linings                             | Replace linings (See paragraph 92.)                         |

# 45. FINAL DRIVE.

## a. Oil Leak Around Sprocket Hub.

- | Possible Cause   | Possible Remedy            |
|--|----------------------------|
| (1) Outer bellows seal failure<br>(a) <b>Symptom.</b> —Oil leak on outside of sprocket | Report to proper authority |
| (2) Inner bellows seal failure<br>(a) <b>Symptom.</b> —Oil leak on inside of sprocket  | Report to proper authority |

- |   |                            |
|---|----------------------------|
| (3) Improper adjustment of sprocket bearings or bearing failure | Report to proper authority |
| (4) Sprung sprocket shaft                                       | Report to proper authority |

**b. Wear On Side of Sprocket Teeth.**

- | <b>Possible Cause</b>                                 | <b>Possible Remedy</b>           |
|---|----------------------------------|
| (1) Track roller frame out of alignment with sprocket | Report to proper authority       |
| (2) Badly worn track rollers                          | Report to proper authority       |
| (3) Track coming off rollers                          | Adjust track (See paragraph 96.) |

**46. TRACKS.**

**a. Tracks Become Too Tight.**

- | <b>Possible Cause</b>                 | <b>Possible Remedy</b>                                  |
|---------------------------------------|---|
| (1) Mud, sand or snow packed in track | Clean and loosen track if necessary (See paragraph 95.) |
| (2) Recoil spring bolt broken         | Report to proper authority                              |

**b. Tracks Come Off.**

- | <b>Possible Cause</b>                        | <b>Possible Remedy</b>      |
|--|-----------------------------|
| (1) Tracks too loose                         | Adjust (See paragraph 96.)  |
| (2) Badly worn track rollers                 | Report to proper authority  |
| (3) Front idler out of alignment             | Report to proper authority  |
| (4) Working on side hills in rocks and limbs | Install track roller guards |

**47. TRACK AND CARRIER ROLLERS.**

**a. Rollers Leak Grease At End Collar.**

- | <b>Possible Cause</b>     | <b>Possible Remedy</b>     |
|---------------------------|----------------------------|
| (1) Seals worn or damaged | Report to proper authority |

**b. Flat Spots On Rollers.**

- | <b>Possible Cause</b>  | <b>Possible Remedy</b>                                      |
|--|---|
| (1) Mud and trash packed around rollers preventing them from turning | Dig mud and debris from between the rollers after operation |

## SECTION XVI STARTING ENGINE

### 48. DESCRIPTION AND DATA.

a. **Description.** (See figure 33.)—The starting engine is a two-cylinder, four-stroke cycle gasoline engine mounted on the left side of the Diesel engine cylinder block. The cooling systems are inter-connected and the starting engine exhaust gases pass through a tube in the Diesel engine inlet manifold. This arrangement warms the Diesel engine for starting. The starting engine transmits its power through a plate type clutch and a two-speed transmission to a pinion which is engaged with the Diesel engine flywheel ring gear by means of a hand lever.

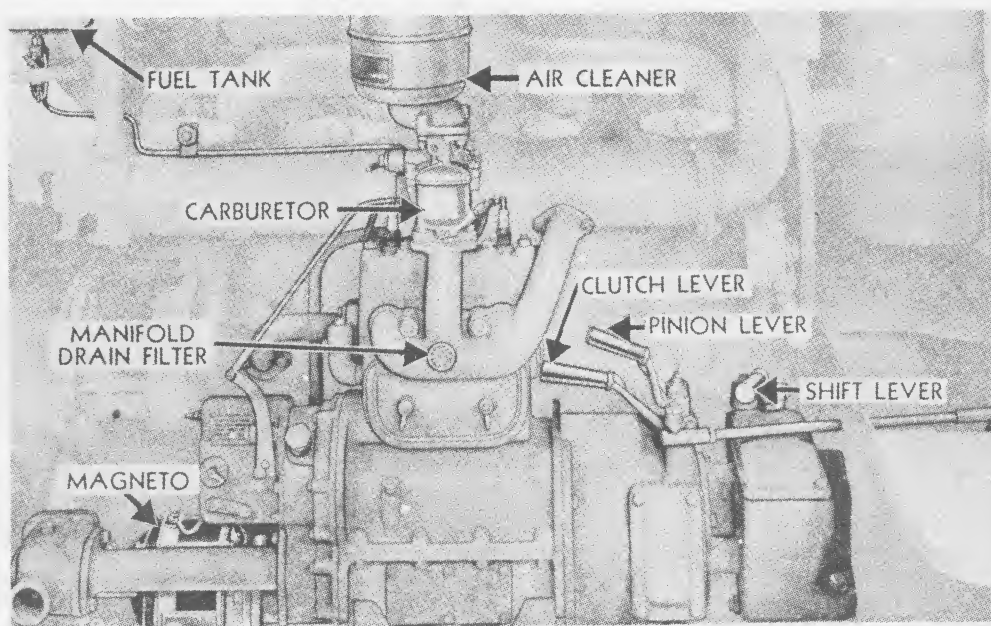


Figure 33—Starting Engine

### b. Data.

Horsepower .....	24 hp
Low idle speed.....	800 rpm
High idle speed.....	2850 rpm
Weight .....	400 lb

#### 49. IGNITION SYSTEM.

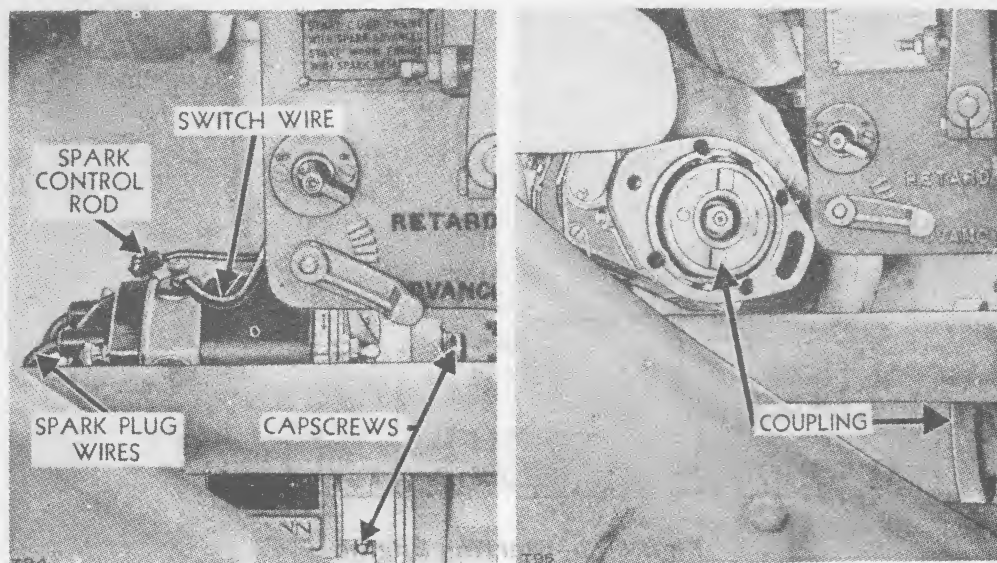
a. **Description.**—An Eiseman Magneto Model RC-2Q with an impulse starter and non-adjustable drive hub is used.

##### b. Testing Magneto.

- (1) **TURN THE SWITCH ON.**—Turn the switch on and remove the cable from a spark plug.
- (2) **HOLD THE CABLE TERMINAL  $\frac{1}{8}$  INCH AWAY FROM SPARK PLUG.**—Hold the cable terminal  $\frac{1}{8}$  inch away from the metal part of the plug while the engine is being cranked.
- (3) **CRANK ENGINE.**—Crank the engine and if no spark passes from the cable to the plug body, disconnect the magneto switch wire from the magneto and try again as the switch may be faulty.
- (4) **IF MAGNETO FAILS TO FIRE.**—If the magneto fails to fire, check the contact point opening. If the contact point opening is correct refer to the proper authority.

##### c. Checking The Contact Point Opening.

- (1) **REMOVE MAGNETO.** (See figure 34.)



**Figure 34—Removing Magneto (Part No. 6B2756)**

(a) **DISCONNECT CABLES.**—Disconnect the cables from the distributor plate, and the wire from the switch.

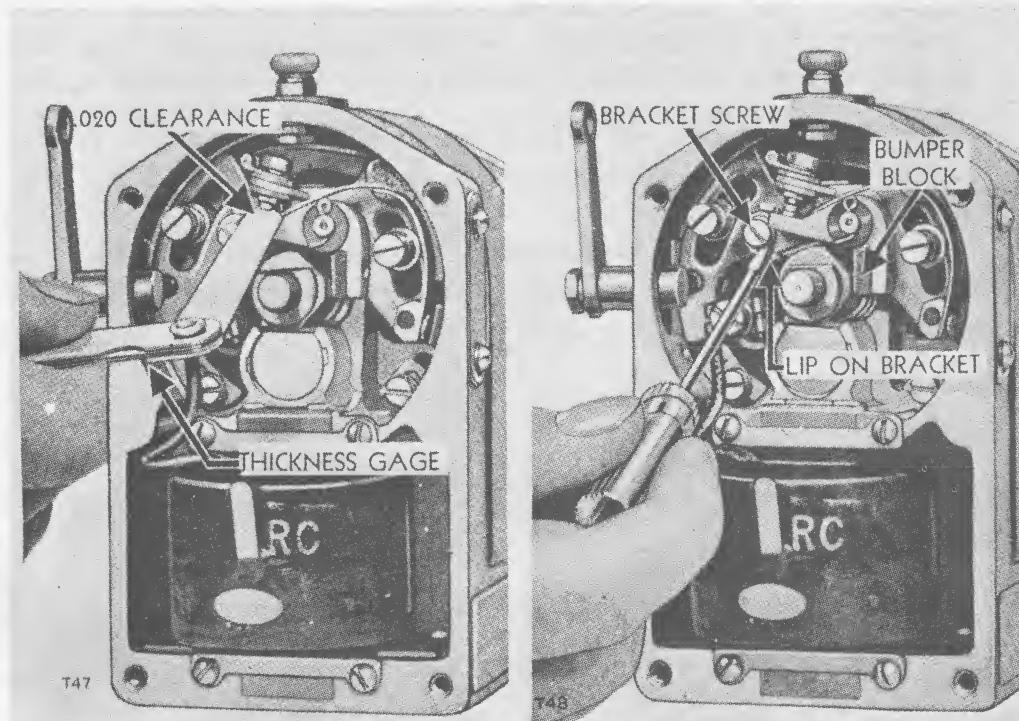
(b) **DISCONNECT SPARK ADVANCE CONTROL ROD.**—Remove the cotter key and pin from the lever on the magneto and remove the rod.

Starting Engine

(c) **REMOVE CAPSCREWS.**—Remove the capscrews holding the magneto in place. Lift off the magneto.

(2) **REMOVE DISTRIBUTOR PLATE.**—Remove the distributor plate and lift out the distributor rotor.

(3) **TURN MAGNETO SHAFT.** (*See figure 35.*)—Turn the magneto shaft backwards (to prevent the impulse from catching) until the bumper block is on the highest elevation of the cam.



**Figure 35—Checking and Adjusting Contact Point Opening**

(4) **CHECK CLEARANCE.**—Check the clearance, which should be .020 inch, with a thickness gage.

**d. Adjusting Contact Point Opening.** (*See figure 35.*)

(1) **LOOSEN CONTACT POINT BRACKET SCREW.**—Loosen the screw that holds the contact point bracket.

(2) **MOVE BRACKET.**—Move the bracket by inserting a screwdriver in the space between the head of the screw and the lip of the bracket.

(3) **TIGHTEN SCREW.**—Tighten the bracket screw and recheck the adjustment.



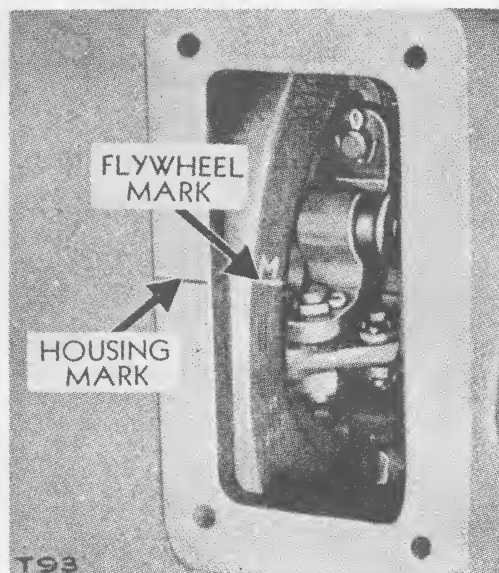
**e. Timing Magneto To Engine.****(1) LOCATE FIRING POINT OF NO. 1 CYLINDER.**

(a) **REMOVE CLUTCH HOUSING SIDE COVER PLATE.**— Remove the cover from the side of the starting engine clutch housing.

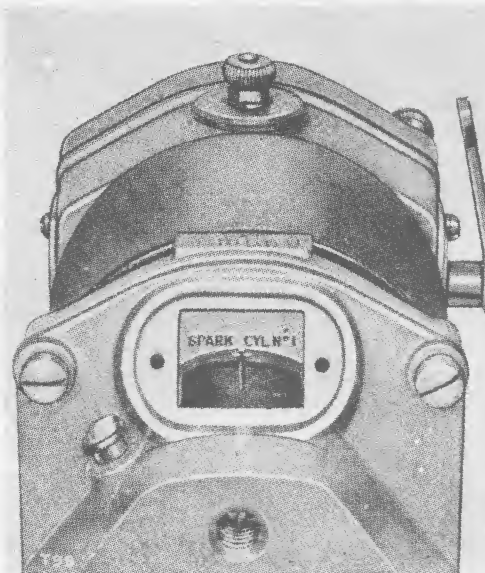
(b) **REMOVE NO. 1 SPARK PLUG.**— Remove the spark plug from No. 1 cylinder which is the one nearest to the radiator.

(c) **DETERMINE COMPRESSION STROKE.**— Turn the crank slowly until a rush of air is noted coming from the cylinder. This is easily detected by holding a finger over the spark plug hole. The rush of air indicates that the piston is coming up on the compression stroke.

(d) **LINE UP MARK ON FLYWHEEL WITH MARK ON HOUSING.** (See figure 36.)— When the piston starts to come up on the compression stroke, continue turning until the "MAG" mark on the flywheel is even with the mark on the housing. The crank on No. 1 cylinder is now 25° ahead of top center on the compression stroke, which is the correct firing point.



**Figure 36—Flywheel and Housing Timing Marks**



**Figure 37—Magneto Timing Marks**

(2) **REMOVE COVER ON END OF MAGNETO.**— Remove the small cover at the end of the magneto by taking out the small fastening screws.

(3) **MAGNETO MARKS.** (See figure 37.)— Turn the magneto shaft backwards (to prevent the impulse from catching) until the white line on the distributor gear lines up with the pointer in the end plate casting.

## Starting Engine

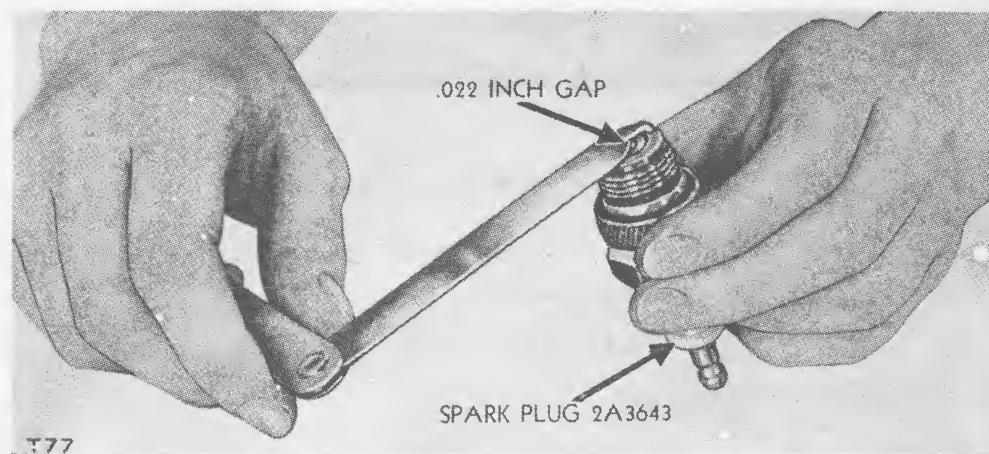
At this point the distributor rotor should be in contact with the conductor which is connected by a wire to the spark plug of No. 1 cylinder, and the contact points should be barely separated.

(4) **SLIDE THE MAGNETO INTO POSITION.**—Slide the magneto into position and bolt it in place.

### f. Starting Engine Spark Plugs.

(1) **SPARK PLUG GAP.** (See figure 38.)—The spark plug gap is .022 inch. Measure the gap with a thickness gage.

(2) **GAP ADJUSTMENT.**—Adjust the gap by bending the outer electrode.



**Figure 38—Checking Spark Plug Gap.**

## 50. STARTING ENGINE FUEL SYSTEM.

### a. Maintenance.

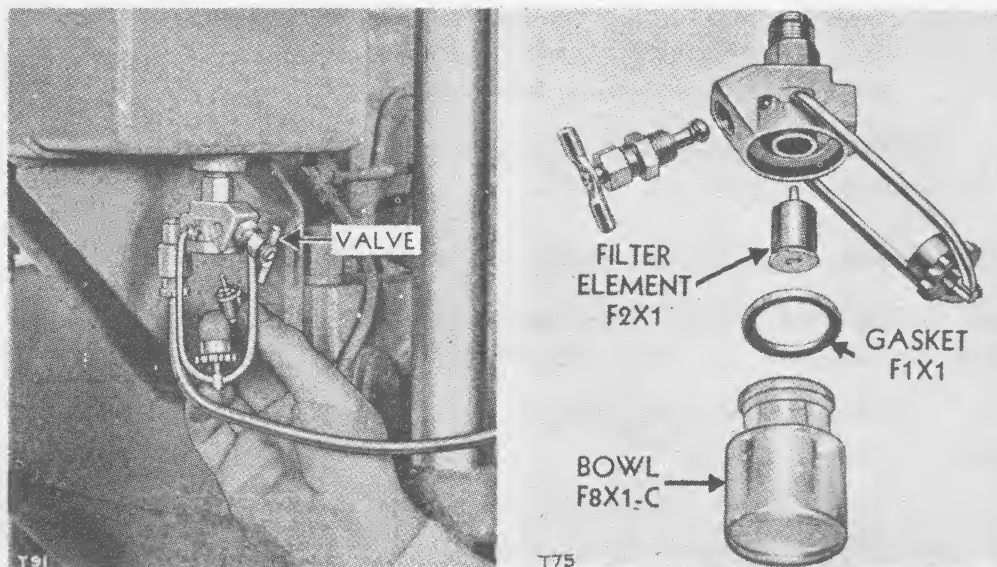
(1) **CLEAN THE SEDIMENT BOWL AND FILTER.** (See figure 39.)

(a) **REMOVE BOWL.**—Close the valve under the fuel tank and remove the sediment bowl by unscrewing the nut clamping it to the body of the valve.

(b) **REMOVE FILTER.**—Unscrew the edge type filter and shake it in Diesel fuel or dry cleaning solvent.

(c) **REPLACE FILTER.**—Screw the filter back in place, being careful not to damage it.

(d) **REPLACE BOWL.**—See that the gasket is clean and replace the bowl. Tighten the screw with the fingers until there are no leaks.

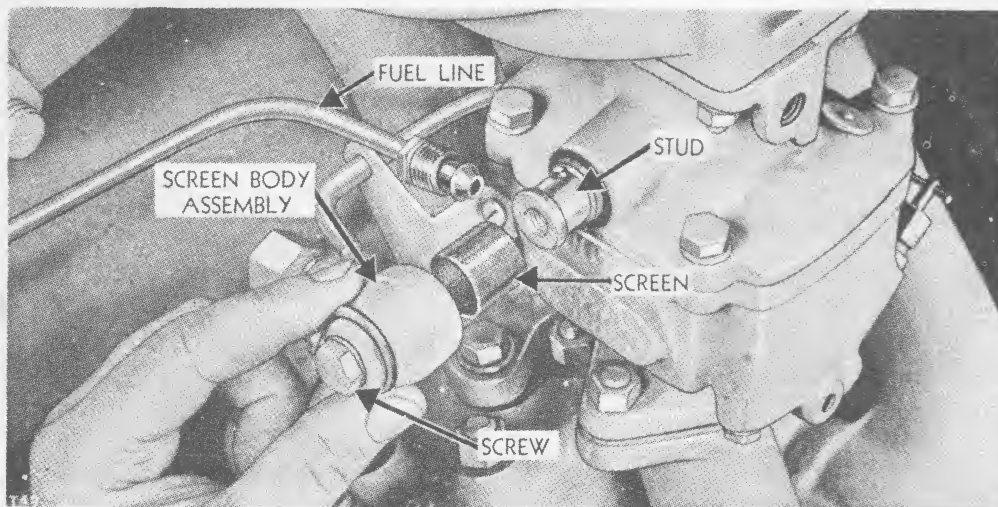


**Figure 39—Removing Sediment Bowl and Filter Element**

(2) CLEAN THE FUEL LINE SCREEN. (See figure 40.)

(a) GENERAL.—The fuel line screen should be removed and cleaned whenever the sediment bowl is serviced.

(b) DISCONNECT FUEL LINE.—Disconnect the fuel line from the screen body assembly.



**Figure 40—Removing Fuel Line Screen**

(c) REMOVE SCREEN BODY ASSEMBLY.—Remove the screw and slide the screen body assembly away from the carburetor.

# Starting Engine

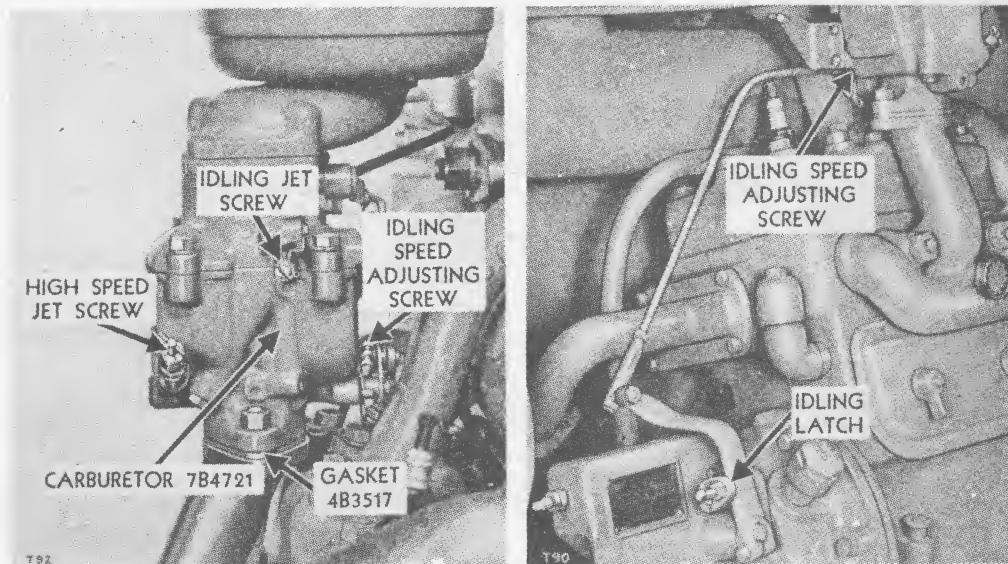
(d) **REMOVE SCREEN.**—Slide the screen off of the stud and wash the screen in dry cleaning solvent.

(e) **REPLACE SCREEN.**—Replace the screen and the fuel line body assembly. Replace and tighten the screw. Replace the fuel line.

(3) **CLEAN THE MANIFOLD DRAIN FILTER.**—Remove the drain filter occasionally from the starting engine inlet manifold and inspect the filter element. If it has deteriorated replace it.

## b. Carburetor.

(1) **APPROXIMATE JET ADJUSTMENT.** (*See figure 41.*)



**Figure 41—Carburetor Adjustments**

(a) **ADJUST IDLING JET SCREW.**—Turn the idling jet screw gently against the seat and back if off one and one-half turns from the closed position.

(b) **ADJUST HIGH SPEED JET SCREW.**—Turn the high speed jet adjusting screw gently against its seat and back it off one and three-eighths turns from the closed position.

(c) **START ENGINE.**—Start the engine and allow it to warm up.

(2) **FINAL JET ADJUSTMENT** (*Engine running.*)

(a) **IDLE ENGINE.**—Lock the throttle lever in the idling position with the idling latch.

(b) **ADJUST IDLING JET SCREW.**—Turn the idling jet adjusting screw until the engine idles evenly without emitting black smoke from the exhaust.



(c) **LIFT IDLING LATCH.**—Lift the idling latch and let the engine run at full governed speed.

(d) **ADJUST HIGH SPEED JET SCREW.**—Turn the high speed jet adjusting screw to a point where the engine runs evenly without surging and does not emit black smoke from the exhaust.

(3) **IDLING SPEED RPM ADJUSTMENT.** (See figure 41.)

(a) **SET IDLING SPEED ADJUSTING SCREW.**—Adjust the idling speed adjusting screw on the carburetor end of the throttle rod, to obtain an engine speed of about 800 rpm.

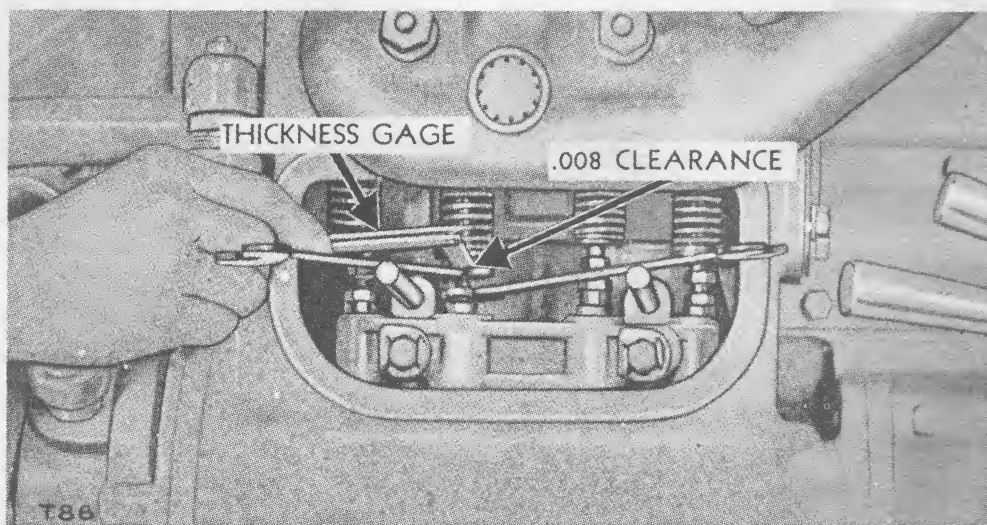
(b) **ADJUST IDLING LATCH.**—Adjust the idling latch screw so that the idle speed adjusting screw is held against the stop.

**51. STARTING ENGINE VALVE CLEARANCE.** (See figure 42.)

a. **Warm Up Engine.**—The valve clearance adjustment should be made with the engine hot.

b. **Remove Valve Cover.**

c. **Crank Engine.**—Crank the engine until the valve to be adjusted



**Figure 42—Adjusting Starting Engine Valve Clearance**

closes and the valve lifter is in its lowest position. Both inlet and exhaust valves are closed when the associated piston is on the compression stroke. The compression stroke can be determined as directed in paragraph 49e.

d. **Loosen Lock Nut.**—Loosen the lock nut on the adjusting screw with a  $\frac{9}{16}$  inch tappet wrench.



## Starting Engine

e. **Turn Adjusting Screw.**—Turn the adjusting screw with a  $\frac{9}{16}$  inch tappet wrench until there is .008 inch clearance between the end of the valve stem and the head of the adjusting screw.

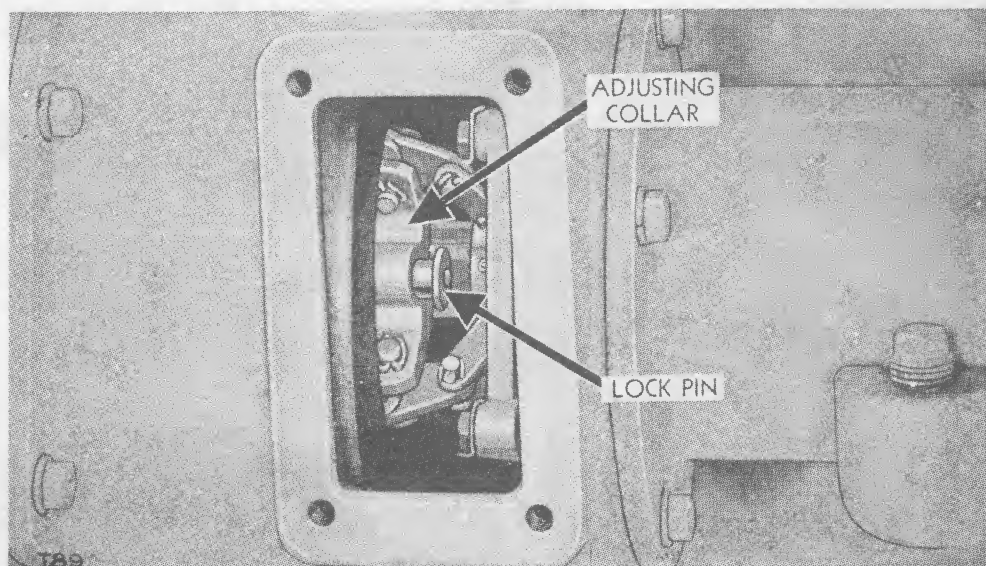
f. **Tighten Lock Nut.**—Tighten the lock nut and recheck the adjustment.

g. **Replace Valve Cover.**

## 52. STARTING ENGINE CLUTCH. (See figure 44.)

a. **Maintenance.**—Test the clutch frequently and adjust when necessary. If oil is noticed in the housing, remove the plug under the clutch housing and permit it to drain.

b. **Testing Adjustment.**—Pull the clutch lever to the engaged position. The lever should go into this position with a distinct snap, and should require a reasonably hard pull.



**Figure 43—Starting Engine Clutch Adjustment**

c. **Adjusting Procedure.** (See figure 43.)

(1) **REMOVE INSPECTION PLATE.**—Remove the inspection plate from the side of the clutch compartment.

(2) **LOCATE LOCK PIN.**—Turn the adjustment collar until the lock pin is accessible.

(3) **PULL OUT LOCK PIN.**—Pull out the spring loaded lock pin.

- (4) **TURN COLLAR.**—Turn the collar to the right until the lock pin drops into the next hole.
- (5) **TEST ADJUSTMENT.**—Test the adjustment by engaging the clutch. If one hole gives a slightly loose adjustment and the next hole gives too tight an adjustment, use the loose adjustment.
- (6) **REPLACE INSPECTION PLATE.**

### 53. STARTER PINION. (See figure 44.)

a. **Description.**—The starting engine power is transmitted to the Diesel engine flywheel through a pinion which is manually engaged with the flywheel ring gear. The pinion is held in engagement by latches which release by the increased centrifugal force when the Diesel engine starts. When the latches release, a spring pushes the pinion out of engagement with the ring gear.

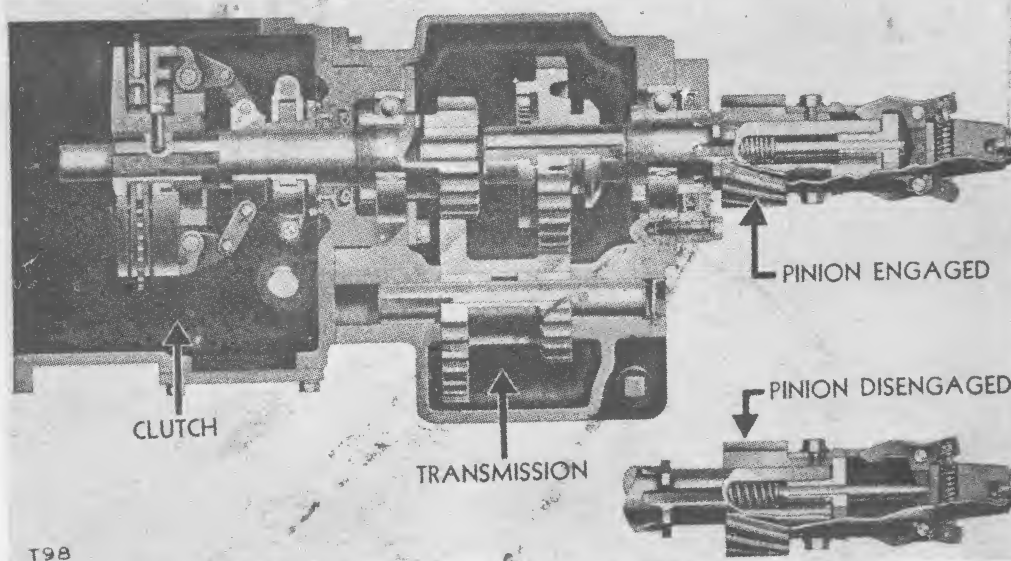
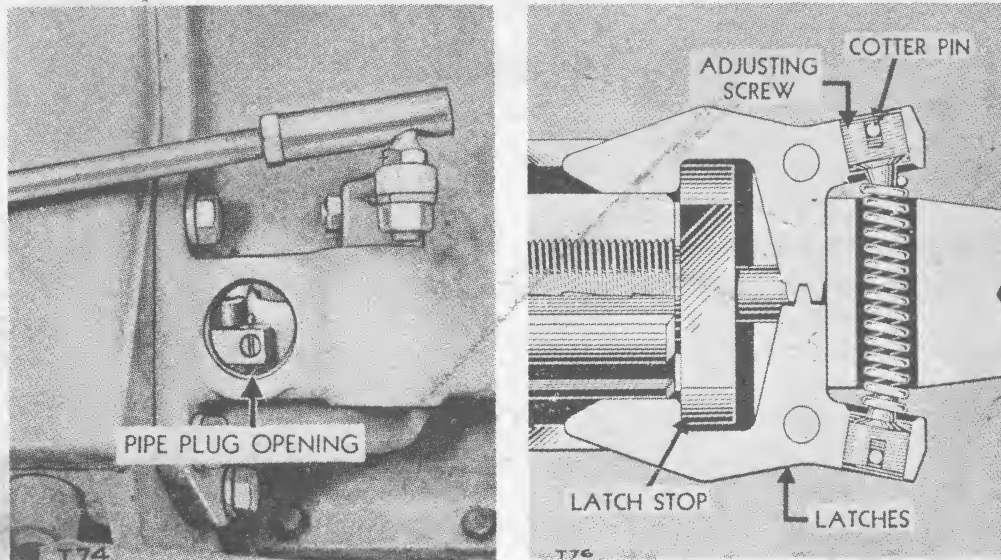


Figure 44—Starting Engine Clutch, Transmission and Starter Pinion

#### b. Latch Spring Adjusting Procedure. (See figure 45.)

- (1) **GENERAL.**—Before the latch spring is adjusted all other possible causes of improper starter pinion operation should be eliminated. See paragraph 39 c and d. If the releasing speed is set too high the starting engine may be damaged by overspeeding when the Diesel engine starts.
- (2) **REMOVE FLOOR PLATE.**—Remove the floor plate back of the starting engine transmission.

Starting Engine



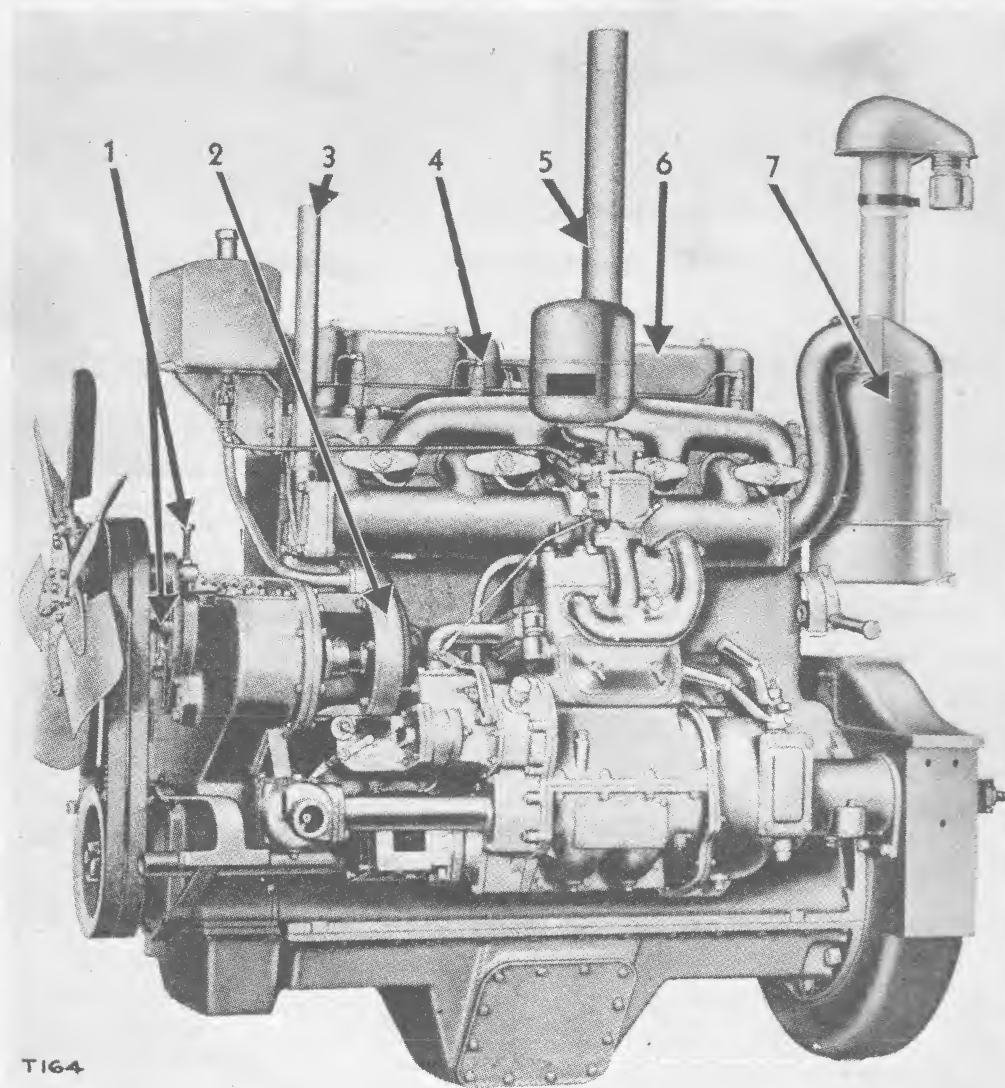
**Figure 45—Starter Pinion Latch Adjustment**

- (3) **REMOVE PLUG.**— Remove the pipe plug from the clutch housing.
- (4) **TURN PINION.**—Turn the pinion until the screw is visible then engage the pinion to hold it in position.
- (5) **REMOVE COTTER PINS.**— Remove the two cotter pins from the latch spring screw heads.
- (6) **TURN SCREWS.**—Turn the adjusting screws clockwise to tighten. Onehalf turn on each screw will increase the releasing speed by 100 to 150 rpm. Tighten just enough to keep the pinion in engagement while the starting engine is cranking the Diesel. Turn the adjusting screws counter clockwise to reduce the releasing speed.
- (7) **REPLACE COTTER PINS.**— Replace the cotter pins, pipe plug and floor plate.

## SECTION XVII DIESEL ENGINE

### 54. SCOPE.

The following section covers the basic engine and identifies the accessories in the two illustrations. (See figures 46 and 48.)



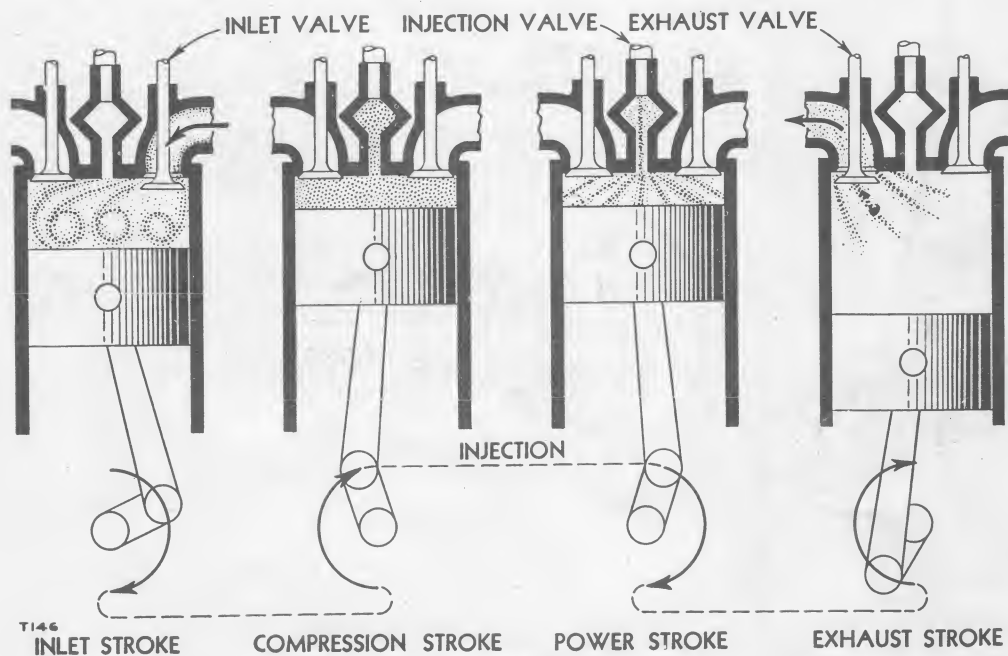
- T164
- |                                  |                                |
|----------------------------------|--------------------------------|
| 1. FAN BELT ADJUSTMENT           | 4. FUEL INJECTION VALVE        |
| 2. WATER PUMP                    | 5. EXHAUST PIPE, DIESEL ENGINE |
| 3. EXHAUST PIPE, STARTING ENGINE | 6. VALVE COVER                 |
| 7. AIR CLEANER, DIESEL ENGINE    |                                |

**Figure 46—Engine Left Side**

Diesel Engine

## 55. DESCRIPTION.

The engine in the D7 tractor is a four-cylinder, four-stroke cycle, valve in head Diesel engine. Individual fuel injection pumps and injection valves are used for each cylinder. The four-stroke Diesel cycle is illustrated in figure 47. During the inlet stroke the inlet valve opens, the piston moves down and only air enters the cylinder.



**Figure 47—Diesel Four Stroke Cycle**

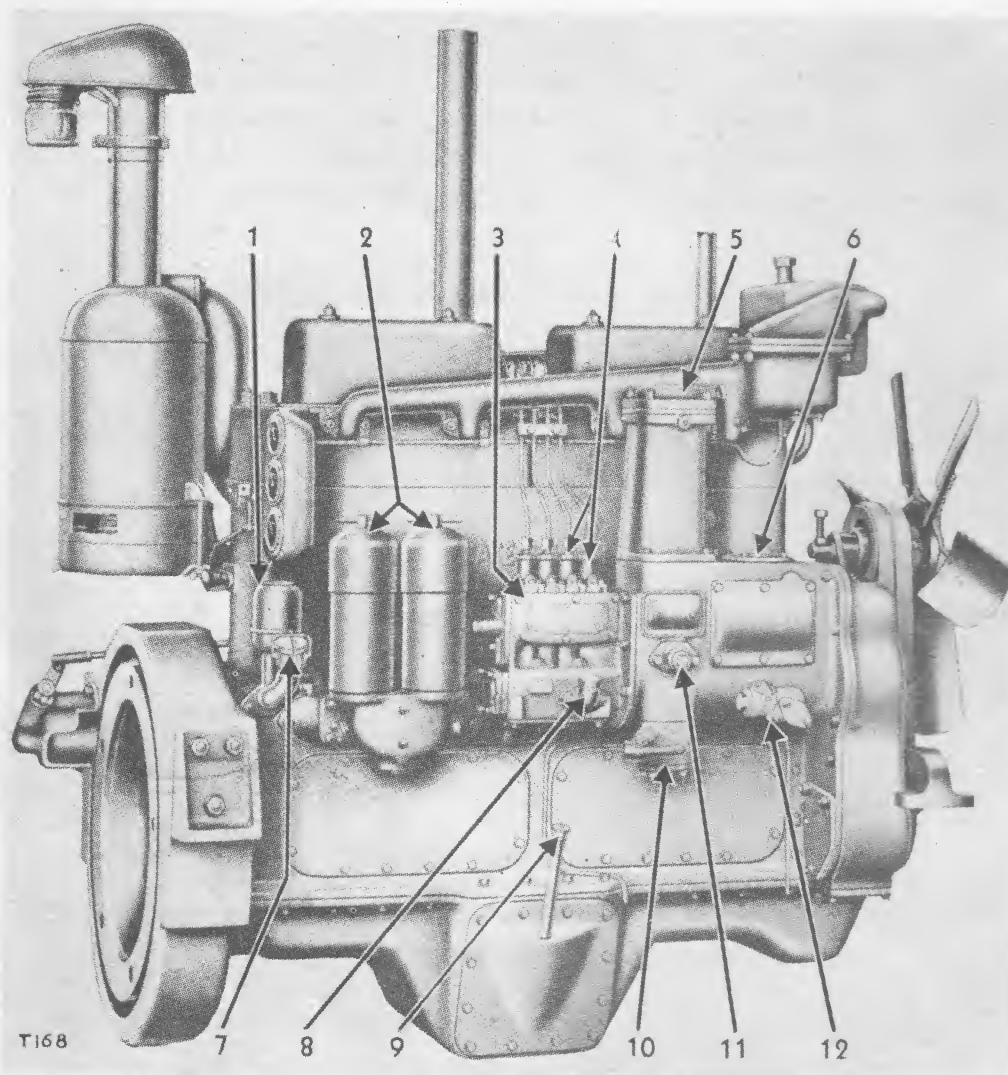
On the compression stroke, the inlet and exhaust valves are closed and when the piston moves up the air is compressed until it reaches a temperature of over 1000°F. Near the end of the compression stroke and during the beginning of the power stroke, fuel is injected into the hot compressed air and spontaneously ignited. The expansion of the burning fuel forces the piston down producing the power stroke.

When the piston moves up again on the exhaust stroke the exhaust valve is opened, the burned gases are forced out of the cylinder and the cycle starts over again.

## 56. DATA.

Model — 4 stroke cycle, water cooled  
No. of cylinders — 4  
Bore and stroke —  $5\frac{3}{4} \times 8$   
Firing order — 1-3-4-2





- |                                |                                       |
|--------------------------------|---------------------------------------|
| 1. BREATHER                    | 7. OIL FILLER, DIESEL CRANKCASE       |
| 2. OIL FILTERS                 | 8. OIL FILLER, INJECTION PUMP HOUSING |
| 3. FUEL INJECTION PUMP HOUSING | 9. OIL LEVEL GAGE, DIESEL CRANKCASE   |
| 4. FUEL INJECTION PUMPS        | 10. FUEL TRANSFER PUMP                |
| 5. FUEL FILTER HOUSING         | 11. FUEL FILTER HOUSING DRAIN         |
| 6. GOVERNOR HOUSING            | 12. HOUR METER                        |

**Figure 48—Engine Right Side**

## 57. CYLINDER HEAD.

**Description.**—Two cylinder heads are used, each one covering two cylinders. The main cylinder head gasket is a copper asbestos gasket but all water passages between the cylinder heads and block are sealed with rubber seals.

## 58. CYLINDER HEAD STUD NUTS.

a. **Removing Rocker Arms.** (See figure 49.)—In order to tighten the stud nuts it is necessary to remove the valve covers and rocker arm assemblies. Disconnect the oil lines to the rocker arms, remove the nuts and lift off the rocker arms and shafts as assemblies.

b. **Nut Tightening Procedure.**—Tighten the cylinder head stud nuts with a torque wrench if one is available. Nuts on the  $\frac{7}{8}$  inch diameter studs require 167 foot-pounds and the nuts on the  $\frac{5}{8}$  inch diameter studs require 58 foot-pounds.

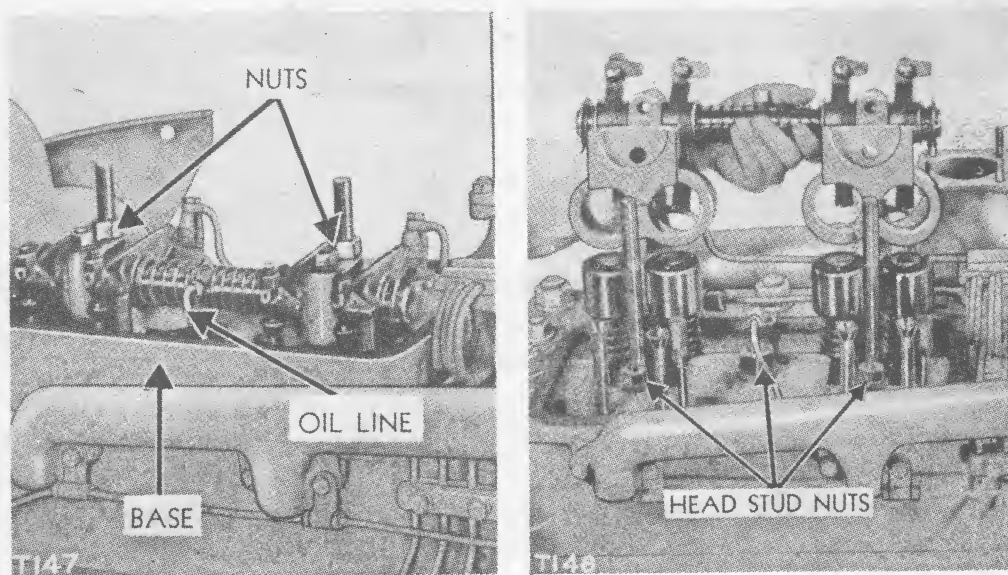
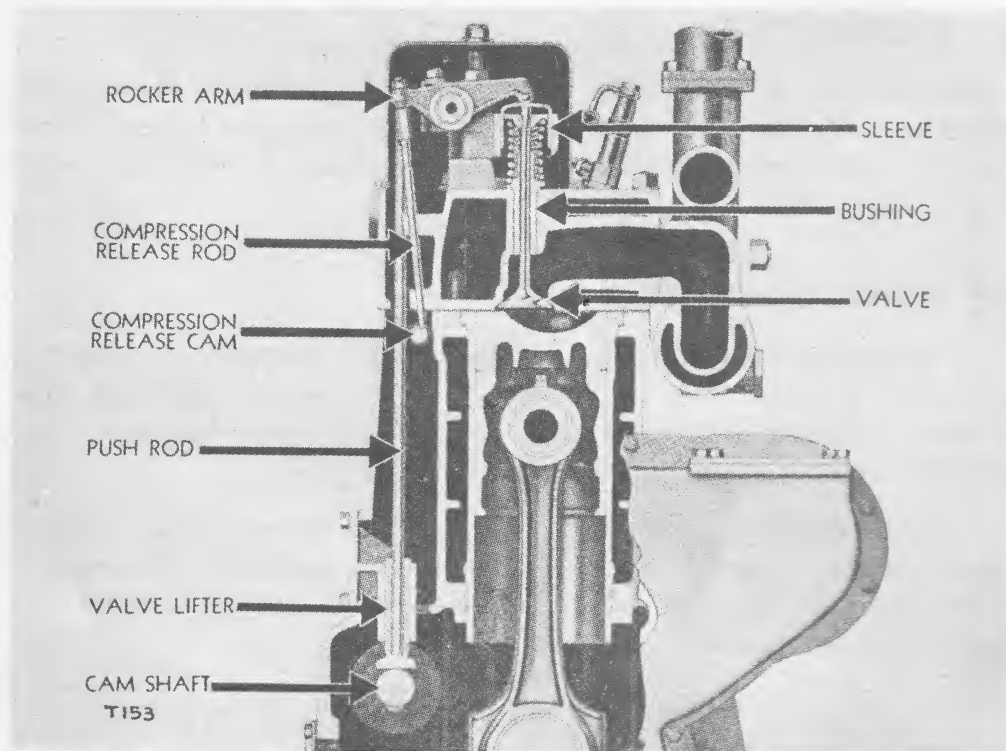


Figure 49—Removing Rocker Arms

## 59. VALVES AND VALVE MECHANISM.

a. **Description.** (See figure 50.)—The inlet and exhaust valves are located in the cylinder heads. The valves are operated by a gear driven camshaft, through a lifter, push rod and rocker arm arrangement. The valve stems operate in replaceable bushings. Sleeves are provided to eliminate side thrust from the valve stems. Compression release for starting is accomplished by a cam and push rods manually controlled, which act on the inlet rocker arms to hold the inlet valves open.



**Figure 50—Valve Mechanism**

#### **b. Adjustment.**

(1) **GENERAL.**—The valve clearance adjustment is correct on both inlet and exhaust valves when there is .012 inch clearance between the valve rocker and the valve stem, with the engine hot, the valves closed and the compression release in the “RUN” position. If the adjustment is not completed while the engine is still warm, start the engine and allow it to warm up again. At the end of the day’s operation, while the engine is at normal operating temperature, is the most desirable time for valve clearance adjustment.

The compression release adjustment should be checked and made at the same time the valve clearance adjustment is checked and made. There must be .025 inch to .030 inch between each compression release push rod and the inlet rocker arm, with the valves closed and the compression release in the “RUN” position.

(2) **REMOVE THE VALVE COVERS.**—Tractors beginning with serial numbers 7M1565 are equipped with two piece valve covers, making it possible to check or adjust valves without removing the hood. Tractors before 7M1565 have one piece valve covers which make it necessary to remove the hood.

Diesel Engine

(3) **CLOSE THE VALVES.** (See figure 51.)—The valves being checked must be entirely closed before the valve and compression release clearances can be checked or adjusted. To close both valves on each of the cylinders listed under A, rotate the crankshaft until the exhaust valve is about to close and the inlet valve starts to open on the cylinders listed opposite under B. If the valves are adjusted in the firing order they can all be adjusted in two revolutions of the crankshaft.

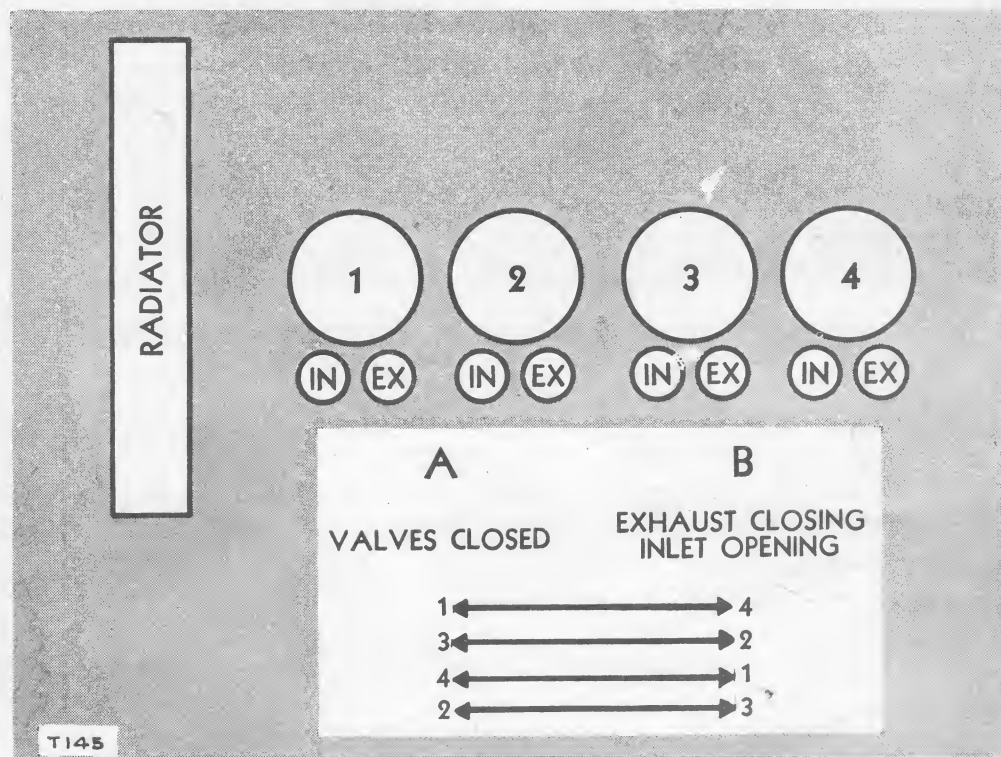


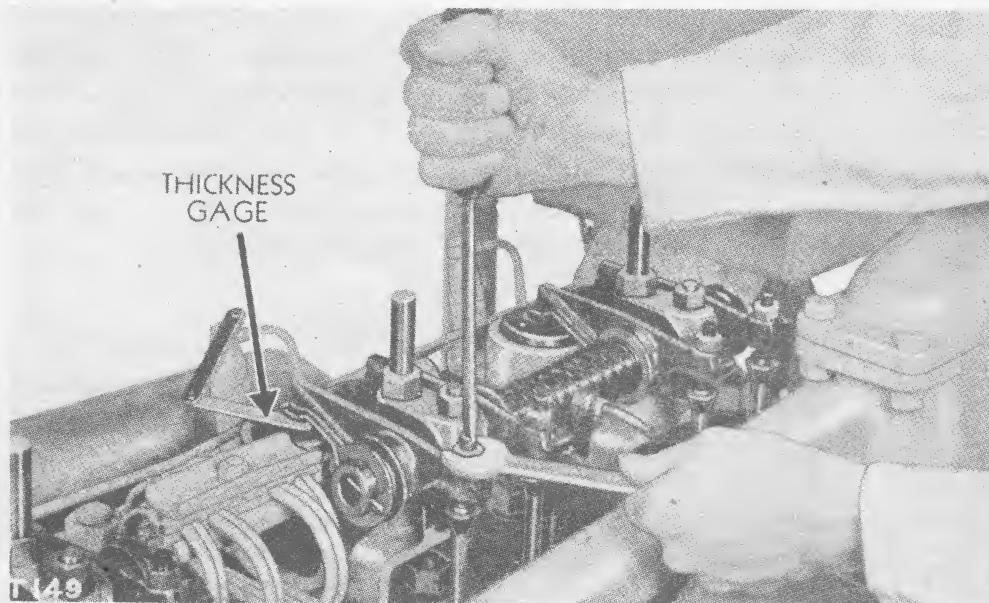
Figure 51—Valve Closing Procedure

(4) **COMPRESSION RELEASE LEVER.**—Move the compression release lever to the “START” position to make it easier to turn the crankshaft but place the lever in the “RUN” position, before the valve clearances are checked.

(5) **ADJUSTING INLET AND EXHAUST VALVE CLEARANCE.** (See figure 52.)

(a) Loosen the adjusting screw lock nut and turn the adjusting screw with a screwdriver until a slight drag is obtained on a .012 inch thickness gage when it is passed between the top of the valve sleeve and the valve rocker.

(b) Tighten the lock nut and recheck the clearance.

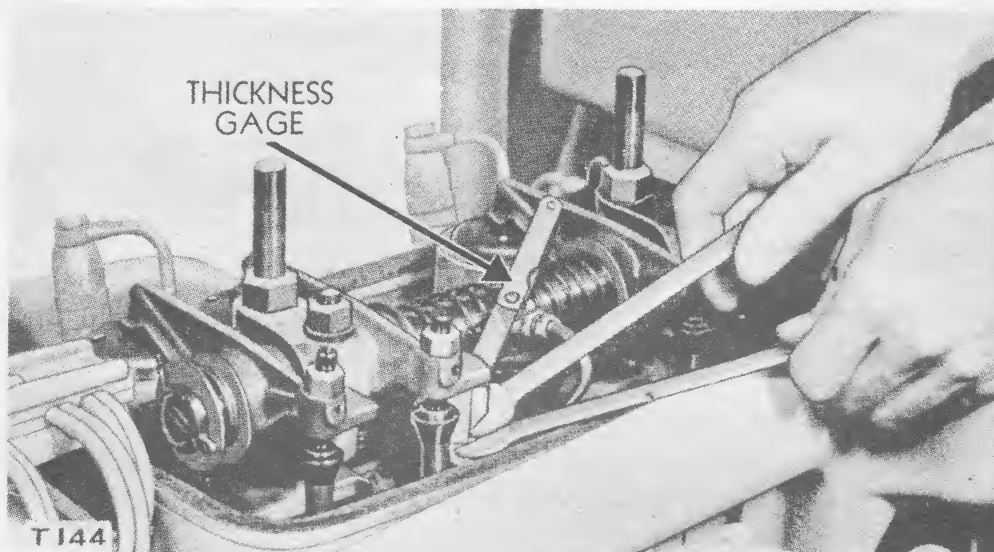


**Figure 52—Adjusting Inlet and Exhaust Valve Clearance**

(6) ADJUSTING THE COMPRESSION RELEASE. (See figure 53.)

(a) Loosen the compression release push rod lock nut and turn the adjusting nut until a slight drag is obtained on a .025 inch thickness gage when it is passed between the end of the push rod and the projection on the inlet valve rocker arm.

(b) Hold the adjusting nut and tighten the lock nut. Recheck the adjustment.



**Figure 53—Adjusting Compression Release Clearance**



Cooling System

## SECTION XVIII COOLING SYSTEM

### 60. DESCRIPTION. (See figure 54.)

The cooling system consists of the following major units: Water pump, water manifolds, water temperature regulators, sealed pressure overflow valve, radiator, fan and connecting pipes and hoses. The gear driven

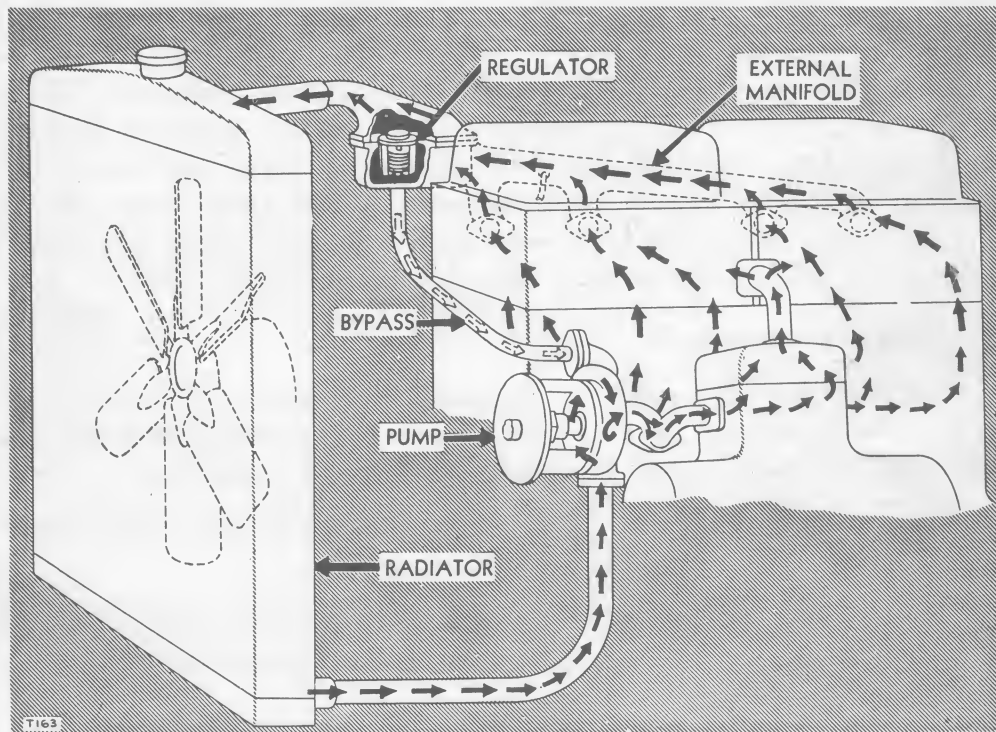


Figure 54—Cooling System

centrifugal water pump circulates the coolant through both the starting engine and Diesel engine. This aids in starting the Diesel engine since the starting engine heat warms the coolant in the entire system. The coolant is forced by the pump to the cylinder block, through water directional tubes into the cylinder head where the flow is directed against the pre-combustion chambers and valves. From the cylinder heads the coolant passes through an external return manifold. A tube from the manifold circulates some of the coolant through a jacket around the fuel filter housing and warms the fuel for cold weather operation. Two water temperature regulators are mounted in the forward end of the manifold and serve to limit the flow of coolant to the radiator in order to maintain proper engine temperature. When the engine is cold, the regulators are closed and the coolant is bypassed to the water pump by

means of a bypass tube. After the engine warms up, the regulators open and the coolant flows through the radiator. When the temperature regulators are open the coolant then passes through the radiator and into the pump to complete the cycle. A sealed pressure overflow unit is used on tractors above serial number 7M3551. This serves to keep the coolant from running out of the overflow pipe when the tractor is operating at extreme angles and also prevents in some measure the loss of antifreeze by evaporation. The fan is driven by two V-belts from a pulley on the crankshaft.

## 61. RADIATOR AND WATER JACKET MAINTENANCE.

a. **General.**—General maintenance of the radiator and water jacket involves several points: Keep sufficient clean cooling liquid in the system. Clean, flush and refill the system whenever inspection reveals unusual accumulation of lime, rust or scale. Always clean seasonally as well as before and after using antifreeze solutions. Clean leaves and debris from between the radiator core and guard.

### b. Draining Procedure.

(1) **GENERAL.**—The system is drained at two points. If the system is to be drained because of repairs it is advisable to save the water for reuse since all of the harmful minerals have already settled out.

(2) **DRAIN RADIATOR.**—Open the drain valve located on the outlet pipe at the bottom of the radiator. (See figure 55.)

(3) **DRAIN DIESEL ENGINE BLOCK.**—Remove the pipe plug located on the cover on the left side of the engine block. (See figure 56.)

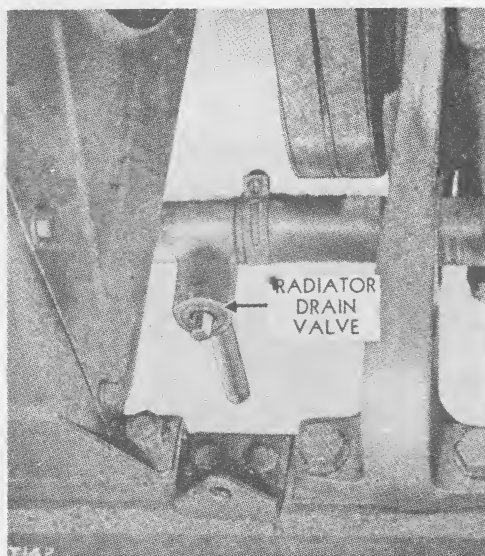


Figure 55—Radiator Drain Valve

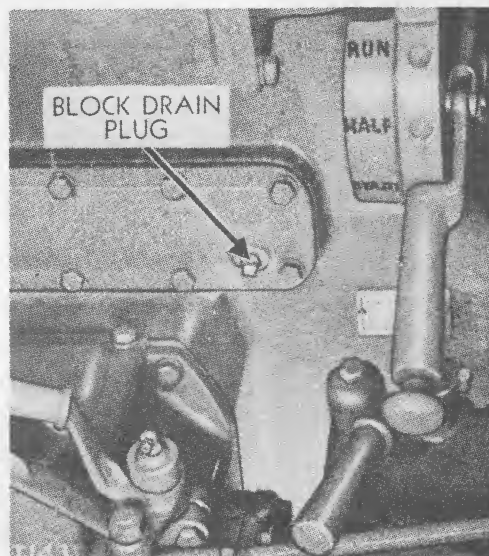


Figure 56—Block Drain Plug

### c. Cleaning And Flushing Procedure.

(1) **CLEANING.**—It is recommended that the cooling system should be cleaned at least twice a year; before the antifreeze compound (ethylene-glycol type) is put into the system, and again after it is removed.

(a) Run the engine until the temperature is within operating range. Stop the engine, remove the radiator cap, and drain the system by opening the drain valve in the radiator (See figure 55.) and removing the drain plug located in the cover on the left side of the block. (See figure 56.)

(b) Allow the engine to cool. Close the drains; pour water slowly into the radiator until the system is approximately half full; then start the engine and set at idling speed. Add the cleaning compound in the proportion of one container of cleaner to every four gallons of cooling system capacity. Then complete filling the system with water.

### NOTE

Never mix the water and the cleaning compound before putting them into the system.

(c) Place a clean drain pan in position to collect the overflow, using the overflow to maintain the level in the radiator, if necessary.

(d) Replace the radiator cap and run the engine at fast idling speed, covering the radiator, if necessary, until the coolant reaches a temperature above 180°F, but not over 200°F. Do not drive the tractor. Constantly check the level in the radiator.

(e) Stop the engine after it has run for 30 minutes at a temperature of at least 180°F, but not over 200°F. Remove the radiator cap, and drain the system completely.

### (2) NEUTRALIZING.

(a) Allow the engine to cool. Close the drains; pour water slowly into the radiator until the system is approximately half full; then start the engine and set at idling speed. Add the neutralizer compound in the proportion of one container of neutralizer to every four gallons of cooling system capacity. Then fill the system with water.

(b) With the radiator covered, let the engine idle for at least five minutes at the normal operating temperature; then stop the engine.

(c) Drain the system completely by removing the radiator cap and opening all the drains.

(3) FLUSHING.

(a) Allow the engine to cool. Close the drains. Pour water slowly into the radiator until the system is approximately half full; then run the engine at idling speed and fill the system completely.

(b) Run the engine, keeping the radiator covered, if necessary, until the coolant is heated to the normal operating temperature.

(c) Drain the system by removing the radiator cap and opening all the drains. Repeat the flushing operation until the drain water is clear.

(d) Allow the engine to cool and then clean all sediment from the radiator cap, drains and the overflow pipe. Blow insects and dirt from the radiator core air passages with compressed air, blowing from the rear. Use water to soften obstructions if necessary.

(4) LEAKS.—After completing the flushing operation, make certain that the engine has been allowed to cool again. Close the drain cocks. Pour water slowly into the radiator until the system is approximately half full; then run the engine at idling speed, and fill the system completely. Stop the engine when the cooling system is completely full. Examine the entire cooling system for leaks. This is important because the cleaning solution uncovers leaks which already exist, but are plugged with rust or corrosion. Leaks that cannot be corrected by the using organization should be reported to higher authority.

d. **Coolant Service.**

(1) When servicing the tractor for summer, fill the cooling system nearly full with clear water. Add corrosion inhibitor compound in the proportion of one container of inhibitor to each four gallons of cooling system capacity; then complete filling the system with water.

(2) When servicing the tractor for winter, refer to the antifreeze table in paragraph 22, for the proper proportions of Ethylene Glycol and clear water.

## 62. WATER PUMP PACKING NUT ADJUSTMENT. (See figure 57.)

Adjust the packing nut with the engine running using wrench 4A334. Tighten the nut until the leak is stopped; then loosen it slightly to relieve the packing pressure on the shaft. Do not over-tighten the packing nut. Too tight an adjustment prevents the coolant from wetting and lubricating the pump packing and shaft and results in scoring the shaft. Install new packing if the pump still leaks when properly adjusted.

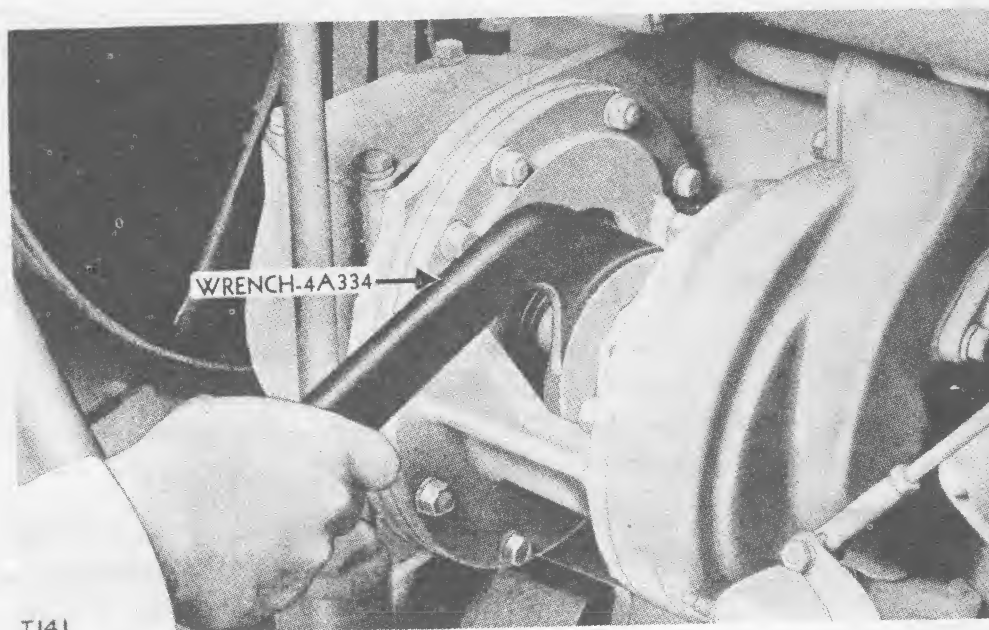


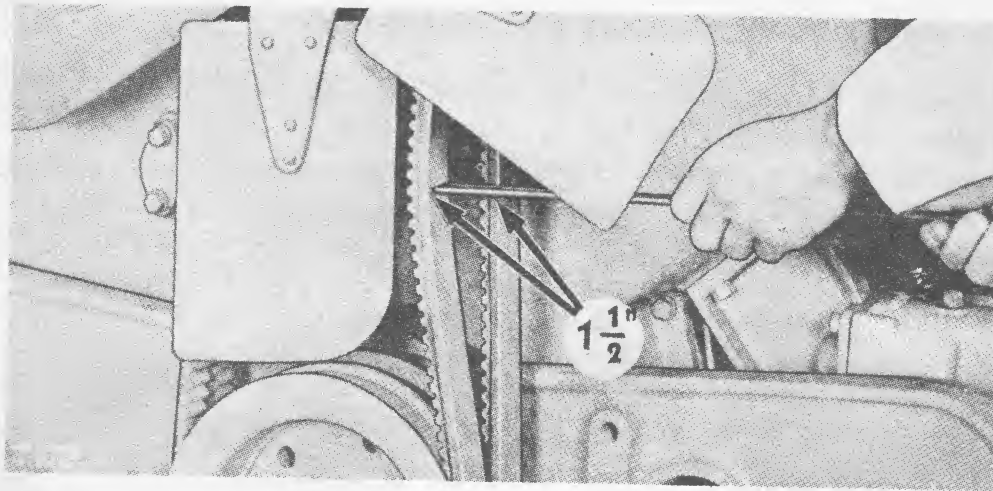
Figure 57—Adjusting Water Pump Packing Nut

## 63. FAN BELT.

### a. Adjustment. (See figure 58.)

- (1) GENERAL.—The fan belts should be adjusted so that with a light pressure they can be pushed inward at the center approximately  $1\frac{1}{2}$  inches.
- (2) LOOSEN THE NUTS HOLDING THE BRACKET.—Loosen the nuts holding the fan bracket to the timing gear cover.
- (3) LOOSEN THE LOCK NUT.—Loosen the lock nut on the adjusting screw. (See figure 59.)
- (4) TURN THE ADJUSTING SCREW.—Turn the adjusting screw clockwise to tighten the belts and counterclockwise to loosen them.
- (5) TIGHTEN THE NUTS.—Tighten the adjusting screw lock nut and the fan bracket retaining nuts after the adjustment is made.





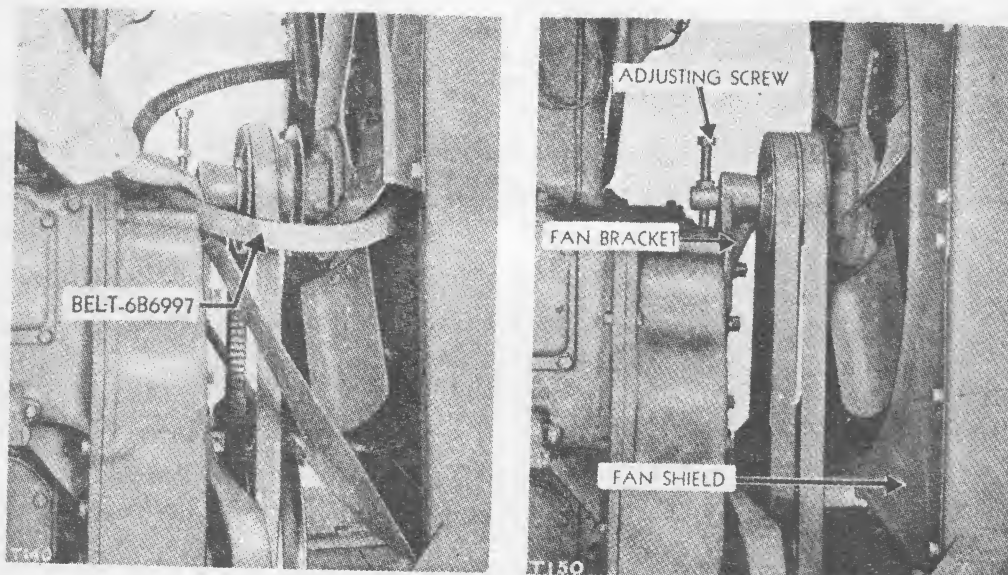
**Figure 58—Correct Fan Belt Adjustment**

**b. Belt Replacement.** (See figure 59.)

(1) GENERAL.— Sometimes one belt may wear more than the other. Generally both belts should be replaced even if one is apparently in good condition. Otherwise they will not be of equal length and proper adjustment cannot be made.

(2) REMOVE FAN SHIELD.— Remove the capscrews which hold the lower section of the fan shield to the radiator and allow the shield to rest against the timing gear housing.

(3) LOOSEN FAN BRACKET.— Loosen the nuts holding the fan bracket to the timing gear housing.



**Figure 59—Replacing Fan Belts**

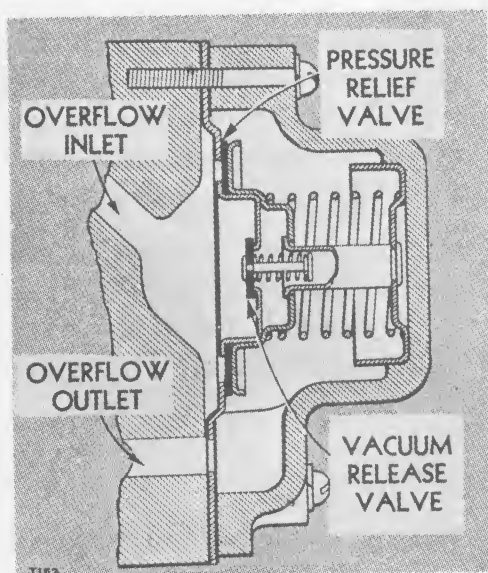
# Cooling System

(4) **LOOSEN FAN BELTS.**— Loosen the lock nut and back off the adjusting screw until the belts are loose enough to be removed from the lower pulley.

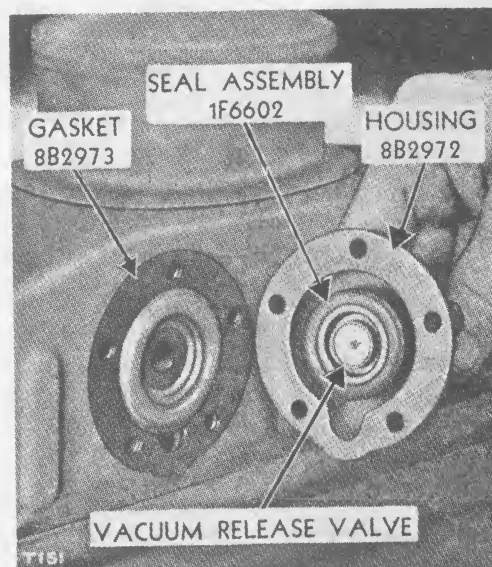
(5) **REPLACE BELTS.**— Remove the belts by sliding them up between the fan and the radiator. Install new belts, in the reverse order of removal.

## 64. SEALED PRESSURE OVERFLOW VALVE.

a. **Description.** (See figure 60.) —The sealed pressure overflow valve serves two purposes: To prevent the loss of coolant when the tractor operates at extreme angles and to reduce the loss of coolant and anti-freeze by evaporation. It operates in the following manner: Due to expansion of the coolant by rising temperatures, a pressure will be built up in the cooling system each time the engine is started. When the pressure rises above six lb./sq.in., the pressure relief valve opens to relieve the pressure, or, if the cooling system has been overfilled, allows some of the coolant to escape. The valve closes when the temperature of the coolant levels off and remains closed unless there is a further increase in pressure. When the temperature of the coolant falls, a vacuum will result in the cooling system. The vacuum release valve opens when the vacuum reaches one lb./sq. in. and lets in air through the overflow tube. This valve also functions when draining the cooling system.



**Figure 60—Sealed Pressure Overflow**



**Figure 61—Removing Sealed Pressure Overflow**

b. **Maintenance.**—The sealed pressure overflow unit should be removed occasionally for inspection and cleaning.

**c. Replacement Procedure.** (See figure 61.)

- (1) **REMOVE THE HOUSING.**— Remove the housing from the radiator top tank by taking out the screws that hold it in place.
- (2) **REMOVE THE SEAL ASSEMBLY.**— Remove the seal assembly by prying under opposite edges of the relief valve.
- (3) **INSTALL THE SEAL ASSEMBLY.**— The seal assembly is installed by placing it in the housing and pressing down evenly with the thumbs on the pressure release valve seal. Be sure the seal assembly is firmly seated in the housing before installing the housing on the radiator.

## SECTION XIX

### FUEL SYSTEM

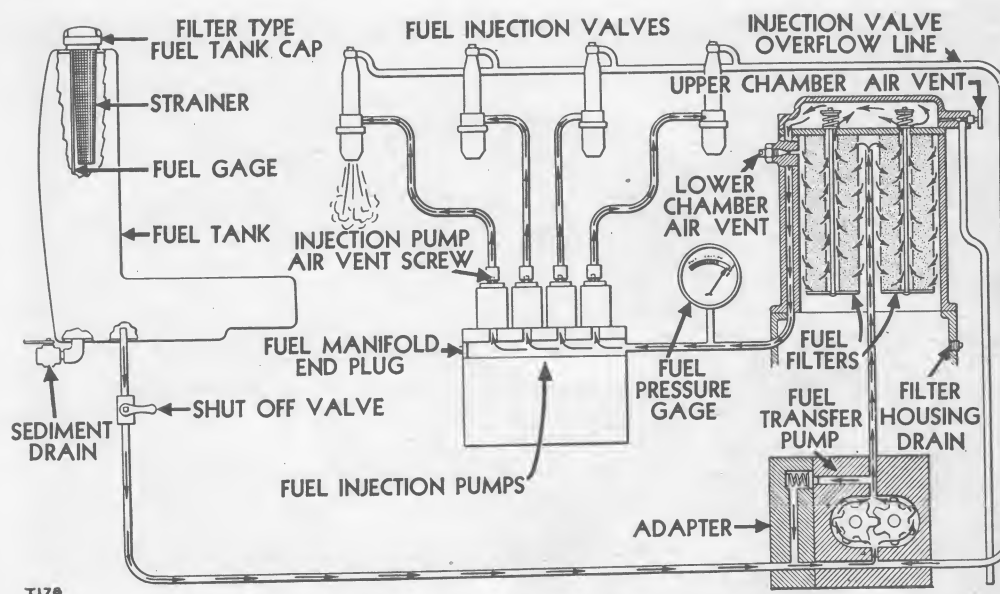
**65. GENERAL DESCRIPTION.** (See figure 62.)

- a. The fuel system is divided into two sections which are referred to as the *supply* or low pressure side and the *injection* or high pressure side. The supply side consists of the fuel tank, transfer pump, fuel filters, fuel pressure gage and connecting lines. The injection side is made up of the fuel injection pump, fuel injection valves and connecting lines.
- b. On the supply side of the fuel system, the fuel flows by gravity from the main fuel tank to the transfer pump. The transfer pump forces the fuel through the fuel filter elements into the upper chamber of the fuel filter housing and down into the individual fuel injection pumps. The fuel pressure gage is connected so as to register pressure on the fuel between the filters and the injection pumps and serves to indicate the condition of the fuel filter elements and the transfer pump.
- c. On the injection side of the system the injection pumps deliver the fuel to the injection valves. The injection valves atomize the fuel delivered to the cylinders. Overflow from the injection valves is carried by a drain tube to the suction side of the transfer pump on tractors after 7M4747.

**66. FUEL TANK.**

- a. **Description.**— The fuel tank has a capacity of 65 gal. and supports the seat cushions. A fuel strainer in the filler opening and an air filter in the cap are provided to aid in keeping dirt out of the fuel. The main fuel line projects up from the bottom of the tank several inches to prevent water and sediment in the bottom of the tank from going directly to the transfer pump. A sediment drain cock is provided to drain off this sediment and water. (See figure 62.)

# Fuel System



**Figure 62—Schematic Diagram of Fuel System**

## b. Maintenance.

(1) Fill the fuel tank at the end of each days operation. This will drive out moisture-laden air and prevent condensation. Every 64 hours, open the drain cock under the fuel tank before starting the engine. Drain off any sediment or water which may have accumulated. The strainer in the fuel tank filler opening should be removed and cleaned regularly. (See figure 63.)

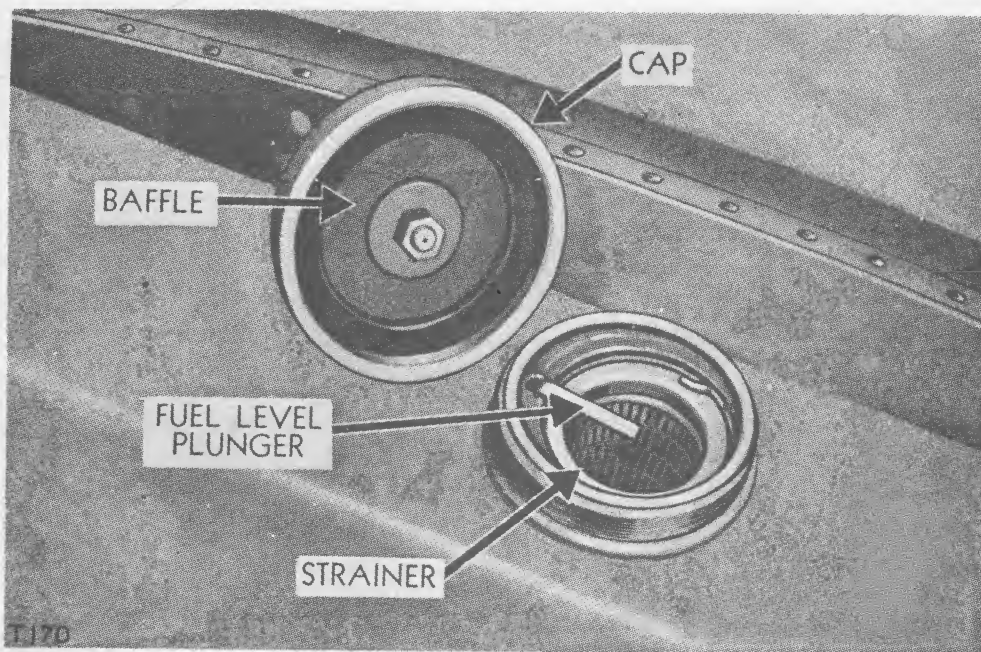
(2) The fuel tank filler cap elements should be washed every 64 to 256 hours depending upon the amount of dust in the air. To do this, remove the nut from the stud and take out the baffle plate and gasket. (See figure 63.) Wash the cap and elements in a pan of Diesel fuel or dry cleaning solvent. After the cap is washed, pour a small amount of crankcase lubricating oil on the filter elements.

## c. Fuel.

(1) **FUEL SPECIFICATIONS.**—While the Diesel engine will operate on almost any petroleum fuel for some time, it is important that good grades of **CLEAN DISTILLATES** be supplied, if the engine is to give trouble-free service. Commercial No. 3 domestic burner fuel, U. S. Army Specifications 2-102B or Navy Department Specification, oil, fuel, Diesel, 7-0-2D provide satisfactory operation.

In sub-zero ( $-18^{\circ}\text{F.}$ ) weather, where warm storage is not provided for the tractor, distillates with unusually low pour points may be required. It is necessary that the fuel be fluid enough to flow from the main tank to the engine transfer pump at the lowest temperature at which the engine must start and operate.





**Figure 63—Fuel Tank Strainer and Cap**

(2) **CARE OF FUEL.**—Too much emphasis cannot be placed on the importance of using only clean fuel. The best fuel can be rendered unsatisfactory by inadequate storage facilities or careless handling. Dirty fuel will result in rapid clogging of the filters, excessive wear on the fuel transfer pump and premature wear on the fuel injection pumps and valves. Water in the fuel will also cause difficulty in the form of unsatisfactory engine performance and rusting of the finely finished parts in the injection equipment. The following suggestions will help assure a clean fuel supply:

(a) **WHERE POSSIBLE USE A LARGE STORAGE TANK.**—Allow the dirt and water to settle for at least 32 hours before using the fuel, then draw from the top, preferably with a pump. Periodically drain water and sediment from the bottom.

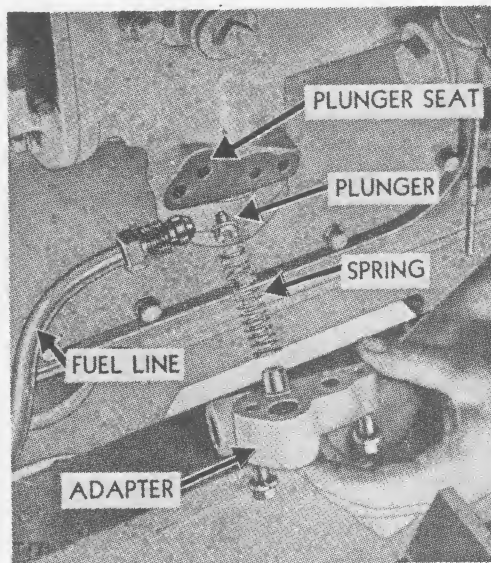
(b) **AVOID THE USE OF OPEN CANS AND FUNNELS.**—If cans must be used, select clean cans with tight caps.

(c) **CLEAN AREA AROUND FUEL TANK CAP.**—Before removing the fuel tank cap, clean the dust and dirt from the cap and surrounding area. If a pump is used on a storage tank, wipe off the nozzle before filling the fuel tank or if cans are used wipe off the cap and top of the can.

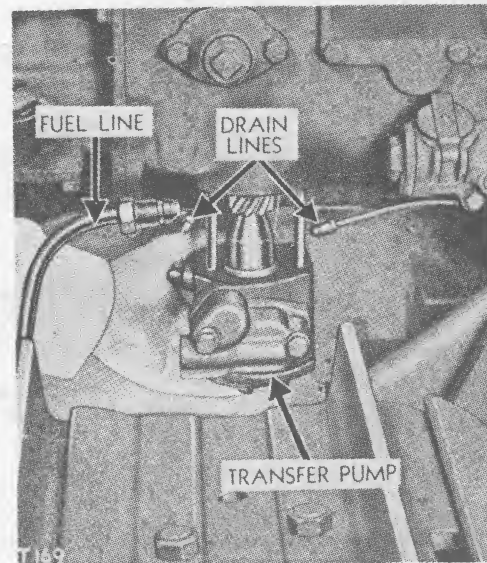


## 67. FUEL TRANSFER PUMP.

a. **Description.**—The fuel transfer pump is a gear type pump mounted on the governor housing. This pump forces fuel through the fuel filter elements to the injection pumps. An adapter mounted on the side of the transfer pump contains a spring loaded plunger which opens to bypass fuel not required by the fuel injection pumps or when the fuel filters become clogged.



**Figure 64—Removing Fuel Transfer Pump Adapter**



**Figure 65—Removing Fuel Transfer Pump**

### b. Fuel Transfer Pump Adapter. (See figure 64.)

(1) **GENERAL.**—If dirt lodges between the plunger in the adapter and the seat on the machined surface of the transfer pump, the effect at slow speed will be similar to that produced by clogged filters. The fuel pressure gage indicator will drop out of the "NORMAL" white range.

#### (2) PROCEDURE FOR CLEANING PLUNGER AND SEAT.

(a) **CLOSE MAIN FUEL LINE VALVE.**—Close the fuel shut-off valve in the main fuel line under the fuel tank.

(b) **DISCONNECT FUEL LINE.**—Disconnect the main fuel line from the adapter.

(c) **REMOVE ADAPTER.**—Take out the two capscrews holding the adapter to the transfer pump body and remove the adapter.

(d) **CLEAN PLUNGER AND SEAT.**—Clean the plunger and seat and replace the adapter in the reverse order of removal. Reconnect the main fuel line and turn on the fuel.

**c. Removing Fuel Transfer Pump.** (See figure 65.)

- (1) CLOSE MAIN FUEL LINE VALVE.— Close the fuel shut-off valve in the main fuel line under the fuel tank.
- (2) REMOVE FUEL LINE CLIP.— Remove the bolt holding the main fuel line clip to the frame of the tractor.
- (3) DISCONNECT FUEL LINE.— Disconnect the main fuel line from the transfer pump adapter.
- (4) DISCONNECT DRAIN LINES.— Disconnect the two drain lines from the transfer pump body.
- (5) REMOVE STUD NUTS.— Remove the four stud nuts holding the transfer pump to the engine and remove the pump as illustrated in figure 65.

**d. Installing Fuel Transfer Pump.**

- (1) CHECK SEALS AND GASKETS.— Be sure the rubber seal, metal ferrule and gasket are in good condition and in place as the pump is installed.
- (2) INSTALL PUMP.— Install the pump in the reverse order of removal.

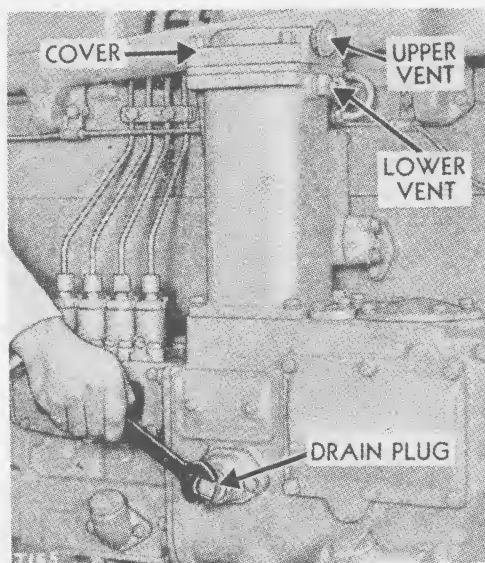
**68. FUEL FILTERS.**

**a. Description.**—The fuel filters are located in one housing on the right side of the engine. The six replaceable filter elements consist of absorbent material wound upon an inner sleeve. As the filters become clogged with foreign material the position of the fuel gage indicator will work back from the original position in the "NORMAL" *white* range to the "OUT" *red* range (engine running.)

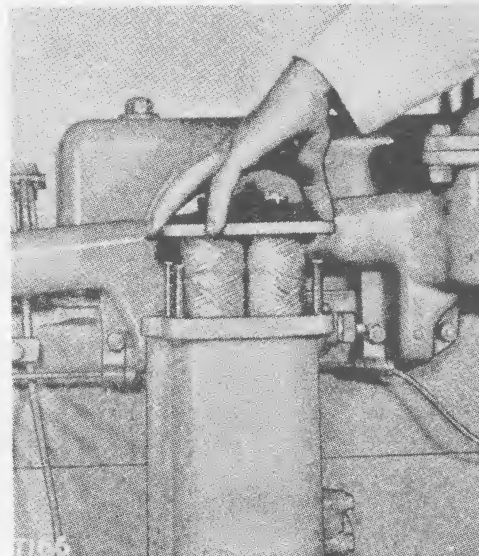
**b. Care.**— Drain the fuel filter housing every 64 hours to remove the water and sediment. (See figure 66.)

- (1) SHUT OFF THE MAIN FUEL LINE VALVE.
- (2) REMOVE DRAIN PLUG.— Remove the drain plug in the fuel filter housing.
- (3) OPEN VENTS.— Open the lower vent valve and then the upper vent valve.
- (4) REPLACE DRAIN PLUG.— Replace the drain plug, close the vents and prime the system as outlined in paragraph 69.

Fuel System



**Figure 66—Draining Fuel Filter Housing**



**Figure 67—Removing Fuel Filter Assembly**

**c. Filter Element Replacement.**

(1) GENERAL.—When the absorbent filters have collected enough contamination to cause the fuel pressure gage indicator to register in the “OUT” range (engine running), they must be replaced. Since these filter elements absorb and hold contaminants, they cannot be washed or otherwise restored.

**(2) REMOVAL PROCEDURE.**

(a) CLOSE FUEL SHUT-OFF VALVE.—Close fuel shut-off valve in main fuel line under the fuel tank.

(b) REMOVE THE HOOD.

(c) DRAIN THE FILTER HOUSING. (See figure 66.)—Remove the drain plug and drain the fuel filter housing.

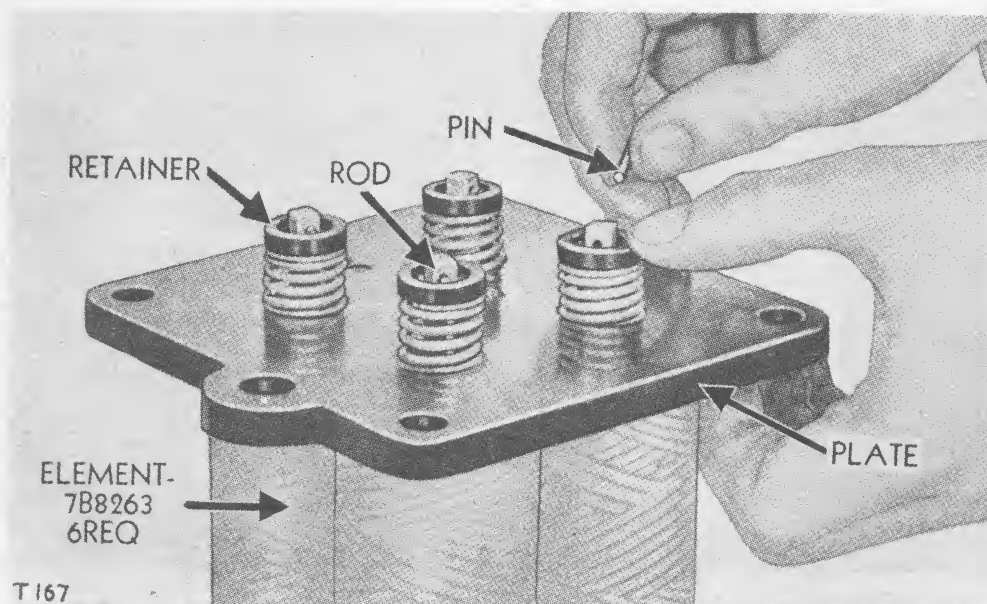
(d) CLEAN THE FILTER COVER.—Clean the top of the filter housing cover to prevent loose dirt from dropping into the filter housing.

(e) REMOVE THE COVER.—Take off the four nuts holding the cover to the housing and remove the cover.

(f) REMOVE THE FILTER ASSEMBLY. (See figure 67.)—Lift out the filter assembly and place it on a flat clean surface.

(g) REMOVE THE RETAINING PINS. (See figure 68.)—Compress each spring and remove the pins.

(h) LIFT OFF THE PLATE.—Lift off the plate and remove the elements from the rods.



**Figure 68—Removing Filter Elements from Plate**

### (3) INSTALLATION PROCEDURE.

(a) **WASH ALL PARTS.**—Wash the cover, plate, retainers, pins and springs carefully in Diesel fuel or dry cleaning solvent. Flush out the housing with Diesel fuel and replace the drain plug.

(b) **PLACE NEW ELEMENTS OVER RETAINER RODS.**—Place new elements over the rods (two elements on each of the two long rods) and attach each rod to the plate by compressing the spring and inserting the pin so it is held securely in the counterbore of the retainer.

(c) **SEAT NEW ELEMENTS.**—Grasp each element at the bottom end and give it a half turn under light pressure to seat the ends of the elements against the plate and against the discs on the bottom of the rods.

(d) **INSTALL FILTER ASSEMBLY IN HOUSING.**—Be sure the cork gaskets are in place and in good condition (one above and one below the plate), then lower the filter assembly into place with the two long rods seated on the dowels in the bottom of the housing.

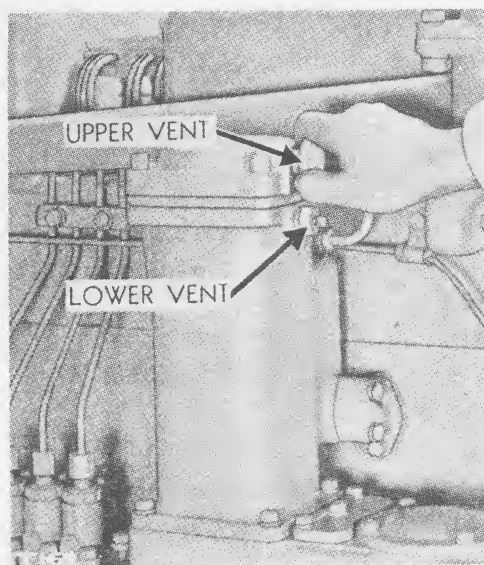
### **CAUTION**

Keep the top side of the retainer plate and the inside of the housing cover clean. These parts are on the "Clean" side of the elements and if dirt is not completely removed it will find its way into the fuel injection equipment.

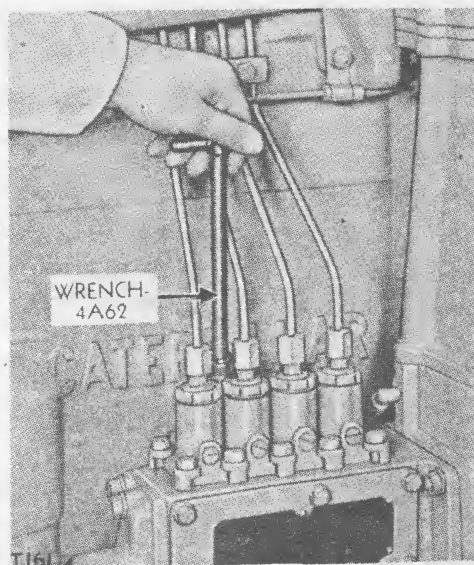
(e) **REPLACE COVER.**—Replace the cover. Install the hood and turn on the fuel.



Fuel System



**Figure 69—Filter Housing Vent Valves**



**Figure 70—Injection Pump Vent Valves**

(f) **PRIME THE FUEL SYSTEM.**—Prime the fuel system as directed in paragraph 69.

**69. PRIMING THE FUEL SYSTEM.**

a. **Purpose.**—Any time the fuel flow is broken and air is allowed to get into the fuel system, the fuel system must be primed. If air is left in the lines, the fuel system will become air bound, resulting in inability to start the Diesel engine or the misfiring of one or more cylinders.

**b. Priming Procedure.**

- (1) **MAKE SURE THE MAIN FUEL LINE VALVE IS OPEN.**
- (2) **SHUT OFF THROTTLE.**—Place the Diesel engine throttle in the "SHUT OFF" position.
- (3) **PLACE COMPRESSION RELEASE LEVER IN "START" POSITION.**
- (4) **OPEN LOWER VENT VALVE.**—Using the vent wrench 4A62, open the lower fuel filter housing vent valve. (See figure 69.)
- (5) **START STARTING ENGINE.**—Start the starting engine and crank the Diesel engine at full cranking speed.
- (6) **OBSERVE THE FLOW OF FUEL FROM THE VENT.**—Observe the flow of fuel from the vent until it is a steady stream without air bubbles.
- (7) **CLOSE VENT VALVE.**—Close the vent valve when no more air bubbles are present.



(8) **REPEAT PROCEDURE.**— Repeat the above procedure with the upper fuel filter vent valve, (See figure 69.) and each of the fuel injection pump vent valves in turn starting with the one nearest the filter housing. (See figure 70.)

(9) **START DIESEL ENGINE.**— Start the Diesel engine to determine if all the air is out of the system. If the engine misses, repeat the priming procedure on each of the fuel injection pump vents with the engine running at idling speed.

## **70. FUEL INJECTION VALVES.**

a. **Description.**— The fuel injection valves are located on top of the cylinder head and each is held in a precombustion chamber by a single large nut. Fuel pressure developed by the injection pump, raises a needle in the injection valve against spring pressure and the fuel is sprayed through a single orifice into the precombustion chamber.

b. **Adjustments.**— The injection valves have no operating adjustments. When the valve is assembled at the factory precise adjustments are made and these adjustments should not be altered during the life of the injection valve.

c. **Care.**— To protect fuel injection valves, drain the sediment and water from the fuel tank and filter housing regularly and never operate the engine without fuel filters. Dirt and water is the most likely cause of fuel injection valve trouble.

### **d. Checking and Replacement Procedure.**

(1) **GENERAL.**— Before removing a fuel injection valve for testing on an engine that is missing, rapping, or puffing black smoke, make the following check to determine which cylinder is causing the difficulty.

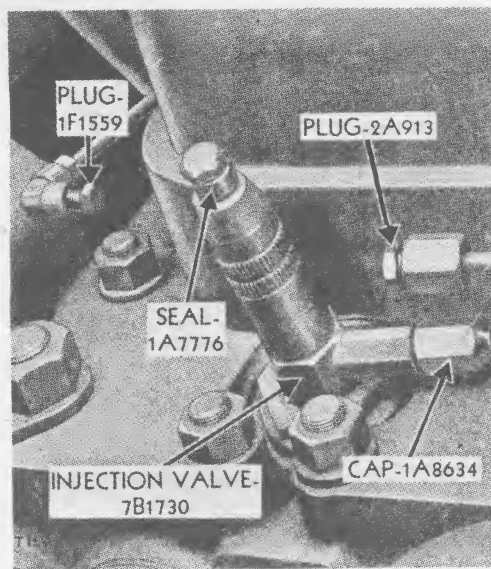
(a) **RUN THE ENGINE.**— Run the engine at a speed which makes the defect most pronounced.

(b) **"CUT OUT" ONE FUEL INJECTION PUMP AT A TIME.**— Loosen the fuel line nut on one fuel injection pump at a time to "cut out" the cylinder. When one is found that makes no difference in the irregular operation of the engine, probably the valve for only that cylinder need be removed and tested.

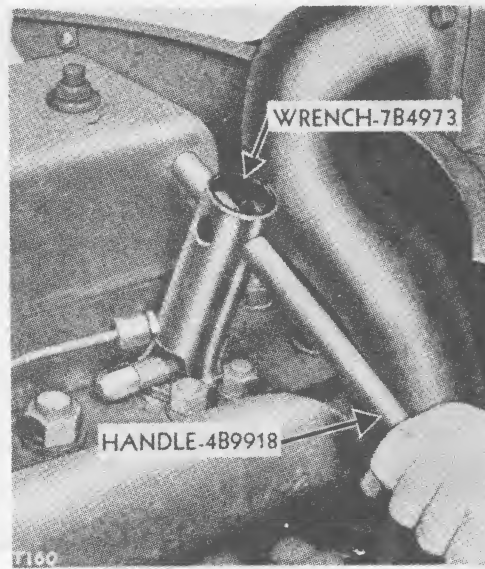
### **(2) REMOVAL PROCEDURE.**

(a) **CLEAN VALVE.**— Clean all dust and dirt from the valve and adjacent areas.

Fuel System



**Figure 71—Preparing to Remove Injection Valve**



**Figure 72—Removing Injection Valve**

(b) **DISCONNECT DRAIN TUBE.**— Disconnect the drain tube from the top of the injection valve and install a 1A7776 seal in its place. (See figure 71.)

**NOTE**

The seals 1A7776, caps 1A8634, plugs 2A913 and plug 1F1559 are included in the tool group.

(c) **DISCONNECT FUEL INLET LINE.**— Disconnect the fuel inlet line and cover the opening in the injection valve with a 1A8634 cap. Cover the opening in the end of the fuel line by screwing in a 2A913 plug. (See figure 71.)

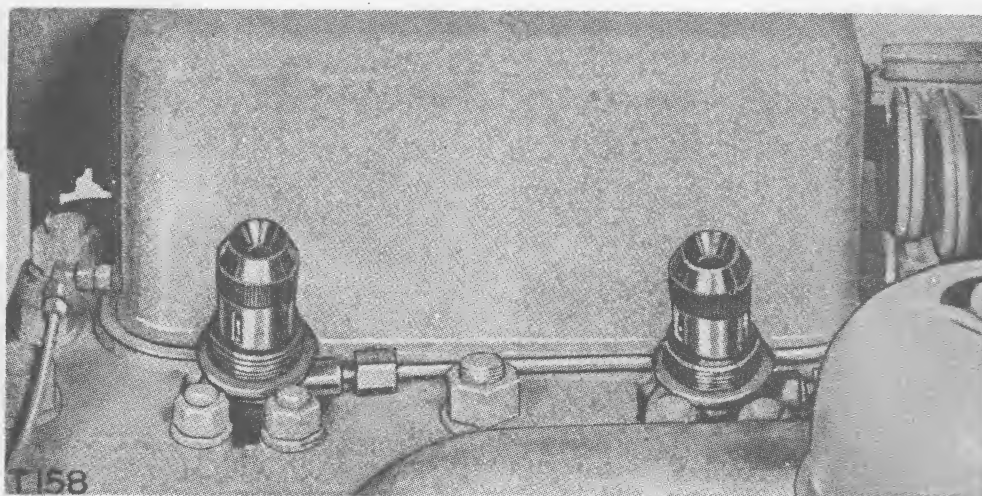
(d) **UNSCREW VALVE RETAINING NUT.**— Unscrew the retaining nut using the wrench 7B4973 and handle 4B9918. (See figure 72.)

(e) **REMOVE INJECTION VALVE.**— Lift the injection valve out of the pre-combustion chamber.

**(3) TESTING A FUEL INJECTION VALVE.**

(a) **INVERT THE VALVE.**— Turn the valve upside down in the precombustion chamber from which it was removed and reconnect the fuel line. (See figure 73.)

(b) **DRAIN TUBE.**— On tractors built after serial numbers 7M4747, disconnect the drain tube and screw a 1F1559 plug in its place in the fitting in the tube leading to the transfer pump. This is necessary to prevent an air lock in the fuel system while the injection valves are being tested. (See figure 71.)

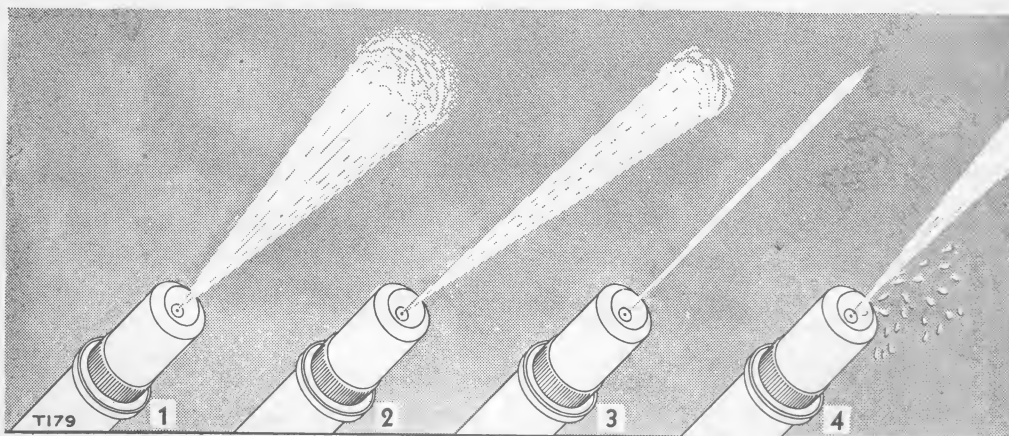


**Figure 73—Injection Valves Inverted for Testing**

(c) IF ONE VALVE IS BEING TESTED.—If only one valve is being tested loosen the fuel line nut above each pump except the one that supplies the valve being tested. This will prevent fuel being injected into the cylinders.

(d) START STARTING ENGINE.—Start the starting engine and with the compression release lever in the start position, crank the Diesel engine at the normal cranking speed.

(e) OPEN DIESEL THROTTLE.—Pull the Diesel throttle all the way back, so that the valves will spray their full amount.



1. CORRECT SPRAY—FINE EVEN SPRAY IN THE FORM OF A CONE
2. INCORRECT SPRAY—FUEL SPRAY EMITTED ON ONE SIDE
3. INCORRECT SPRAY—FUEL DISCHARGED IN A SOLID STREAM OR JET
4. INCORRECT SPRAY—UNEVEN CUT OFF AND DRIBBLE

**Figure 74—Injection Valve Spray Characteristics**

## Fuel System

(f) **WATCH THE SPRAY.**—Watch the spray that comes from the injection valve nozzle. If the discharge is in the form of a fine even mist, it indicates that the valve is in good condition. If the spray exhibits any of the abnormal characteristics illustrated in figure 74, the fuel injection valve should be replaced.

### (4) INJECTION VALVE INSTALLATION.

(a) **TIGHTEN HOLD DOWN NUTS MODERATELY.**—Tighten hold down nuts only tight enough to prevent leaks between the valve and the valve seat. Excessive tightening might cause distortion of the injection valve.

(b) **BE SURE OVERFLOW LINE WASHERS ARE IN PLACE.**—There is a copper washer above and below the drain tube connection at each valve. Tighten the screw moderately. This connection must be air tight on tractors after 7M4747 or the system will become air locked.

## 71. FUEL INJECTION PUMPS.

a. **Description.**—Each pump measures the amount of fuel to be injected into its particular cylinder and produces the pressure for injection. The injection pump plunger is lifted by a cam and always makes a full stroke. The amount of fuel pumped during any one stroke is varied by turning the plunger in the barrel. The plunger is turned by the governor action through a rack which meshes with a gear segment on the bottom of the pump plunger.

b. **Care.**—The life of fuel injection pumps depends on the precautions taken to keep the fuel supply clean. Dirt and water in the fuel contributes to premature pump failure.

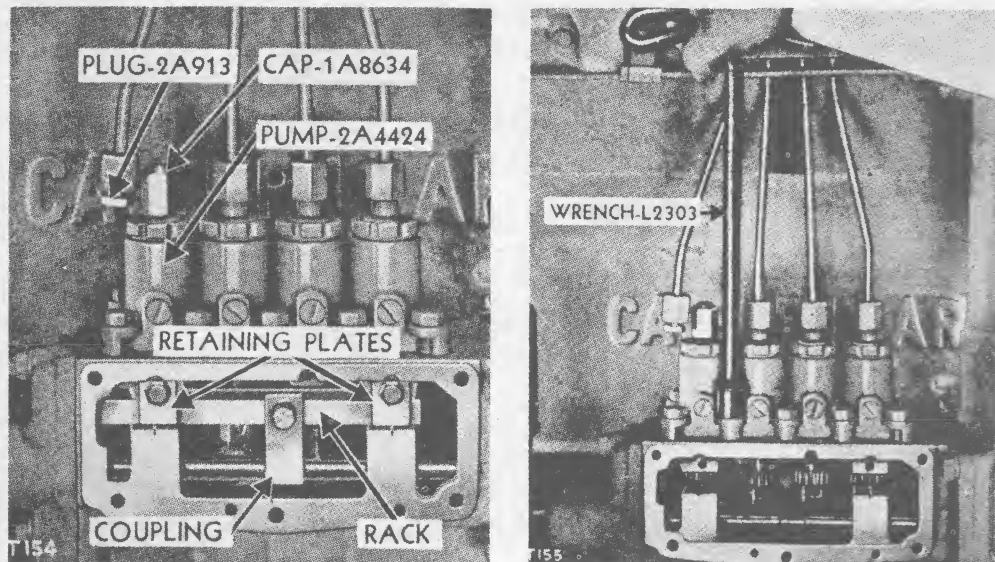
c. **Adjustment.**—All fuel pumps are interchangeable between cylinders on a particular engine and also between engines having the same cylinder bore whether they are four or six cylinder. Each pump is adjusted when assembled at the factory and stays permanently in adjustment. They can be individually replaced without skilled setting.

d. **Testing.**—Worn fuel injection pumps will result in loss of power and hard starting. These same conditions may be present if the piston rings and cylinder liners are badly worn. However, in the case of worn piston rings and liners, the hard starting and loss of power will be accompanied by poor compression, a smoky exhaust and excessive blow-by gases from the crankcase breather.

e. **Injection Pump Removal Procedure.** (See figure 75.)

(1) **CLEAN THE HOUSING.**—Clean the top of the housing and around the inspection plate on the side.





**Figure 75—Preparing to Remove an Injection Pump**

(2) **DISCONNECT FUEL INJECTION LINES.**—Disconnect the lines at the tops of the pumps and immediately cap the openings in the pumps with 1A8634 caps and the openings in the lines with 2A913 plugs.

(3) **REMOVE INSPECTION PLATE.**—Remove the inspection plate by taking out the six capscrews holding it. Note that one capscrew is longer than the others. Be sure it is replaced in the proper location.

(4) **REMOVE COUPLING AND RACK.**—Remove the capscrews holding the rack retaining plates and coupling between the rack and slide bar. Then carefully lift out the rack and coupling. Handle the rack with care since any nicks on its surfaces will result in rough governor action.

(5) **REMOVE THE PUMP HOLD-DOWN CAPSCREWS.**—Remove the capscrews and clamps that hold the pumps in position using the L2303 wrench.

(6) **REMOVE PUMPS.**—Lift out the pumps, individually, in the following manner. (See figure 76.)

(a) Lift the pump straight up until it just clears the dowel pins.

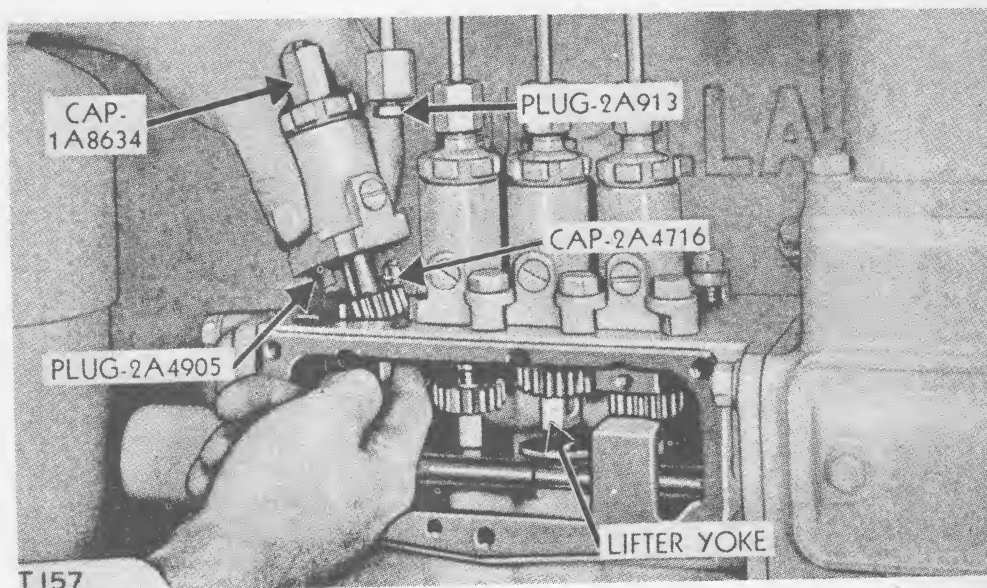
(b) Reach through the side inspection opening and hold the pump plunger from sliding out of the barrel.

(c) Shift the pump sideways to free the plunger end from the lifter yoke.

(d) Lift the pump out of the housing, still holding the plunger in the barrel.



Fuel System



**Figure 76—Lifting Fuel Injection Pump Out of Housing**

**CAUTION**

Never remove the pump plunger from the barrel for any reason. The slightest nick or dirt on the finely ground surfaces will make replacement of the entire pump necessary.

(7) **CAP THE FUEL OUTLET AND INLET HOLES.**—Cap the outlets on top of the pump housing with 2A4716 caps and place 2A4905 plugs in the inlet holes of the pumps. These precautions are necessary to keep out dirt. (See figure 76.)

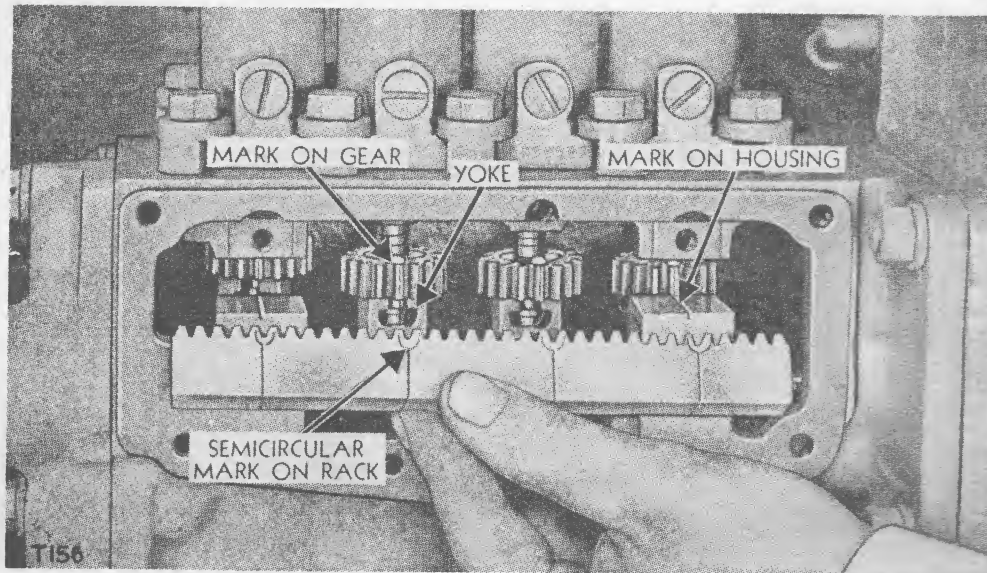
**f. Installation Procedure.**

(1) **REMOVE PLUGS AND CAPS.**—Remove the rubber plug from the injection pump and the cap from the fuel outlet on top of the housing.

(2) **LOWER PUMP INTO HOUSING.**—Lower the pump assembly into the housing taking care not to drop the plunger out of the barrel. Slide the end of the plunger into the yoke on the lifter, (See figure 77.) and lower the pump body onto the dowel pins.

(3) **FASTEN PUMP IN PLACE.**—Install the four hold-down cap-screws and clamps. Rotate the pump plunger gear segment to make sure that the plunger turns freely and does not bind.

(4) **LINE UP GEAR SEGMENTS.**—Turn the pump gears until the marked tooth on each gear faces out. The end pumps can be aligned with the marks on the rack supports of the fuel pump housing. (See figure 77.)



**Figure 77—Aligning Gear and Rack Marks**

- (5) **INSTALL RACK.**—The top of the rack is indicated by semicircular marks. As the rack is slipped into place, the marked teeth must be made to engage the marked teeth on the pump plunger gears.
- (6) **INSTALL RACK RETAINING PLATES.**—Install the rack retaining plates and capscrews. Make sure the beveled edge on the retaining plates is facing IN and toward the top of the housing. Otherwise the plates may bind the rack. Try the rack movement to make absolutely sure that it works freely in the housing.
- (7) **INSTALL COUPLING.**—Install the coupling between the rack and the fuel pump slide bar.
- (8) **CONNECT FUEL LINES**—Connect the fuel injection lines and install the side covers.
- (9) **PRIME THE FUEL SYSTEM.** (See paragraph 69.)

## **SECTION XX**

### **LUBRICATING SYSTEM**

#### **72. DESCRIPTION.** (See figure 78.)

One of the most important items contributing to the long life of an engine is proper lubrication. A full pressure lubricating system has been provided, consisting of an oil pump, filters, oil cooler and pressure gage. The oil pump assembly contains two auxiliary pump sections connected

Lubricating System

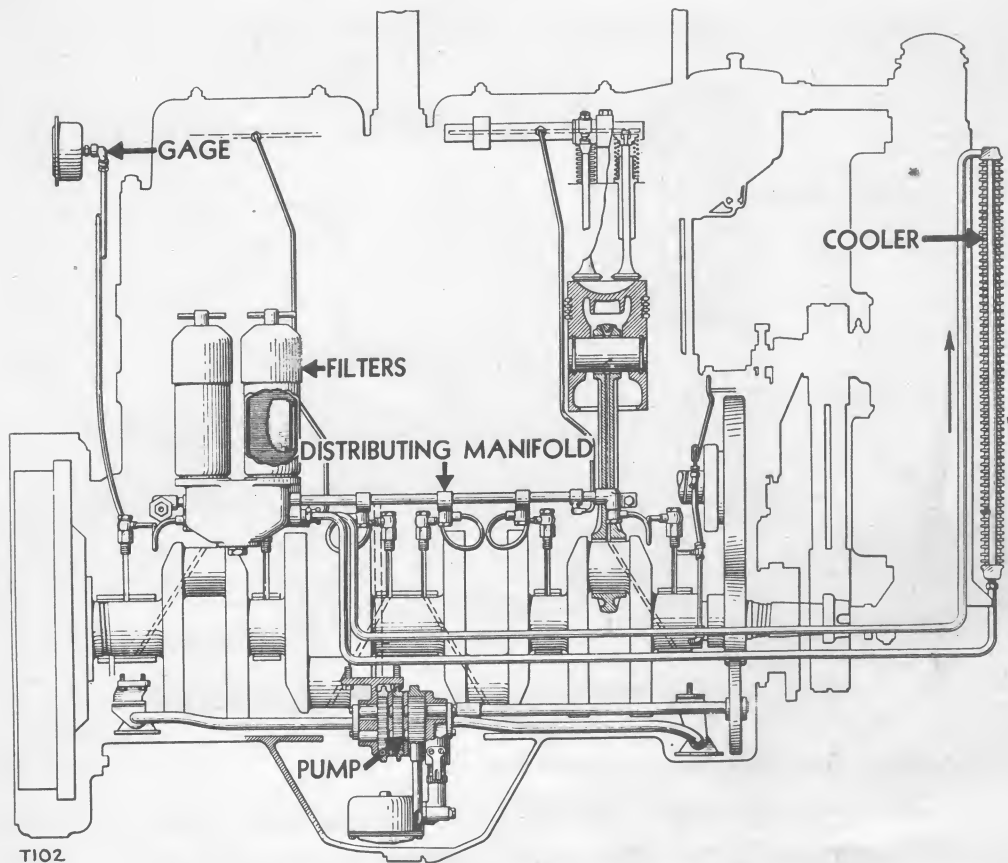
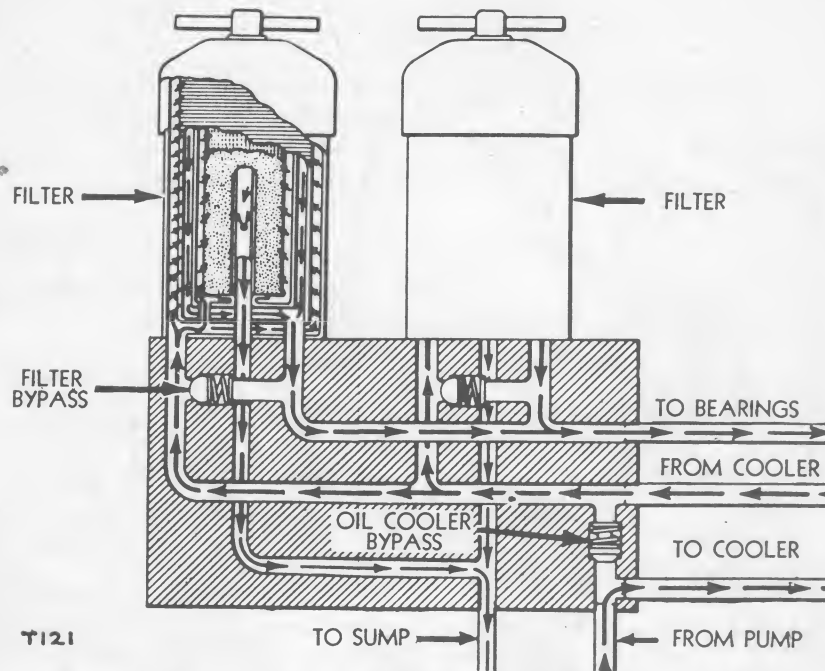


Figure 78—Diagram of Engine Lubricating System

to screened suction bells located at the front and rear end of the oil pan. On steep uphill or downhill operations, these pump sections return accumulated oil from the low end of the oil pan to the center sump in which is located the pressure pump suction bell. The pressure pump circulates the oil under pressure to all working parts of the engine. From the oil pump, the oil is forced through passages in the oil filter base to the oil cooler in front of the radiator, and then back to the filters. After passing through the filters, the oil goes into the oil manifold and is distributed to the main bearings, connecting rod bearings, piston pins and valve rocker assembly. In the event that the oil cooler or oil filters become clogged the oil is bypassed through valves to the bearings.

### 73. OIL FILTERS. (See figure 79.)

a. **Description.**—Two filters on the same base located on the right side of the engine filter the oil as it passes through. Each filter has an edge-type metal element surrounding an absorbent-type element. The oil filtered by the outer metal element goes to the bearings while the oil filtered by the inner element returns to the sump in the crankcase.



**Figure 79—Schematic Diagram of Oil Filters and Base**

**b. Removing The Filter Elements.**

(1) **REMOVE FILTER CASE COVER.**— Remove the filter case cover by turning the hold down wing screw with the hand or by tapping lightly with a hammer.

(2) **LIFT OUT ELEMENTS.**— Lift out the two elements and discard the absorbent element. Handle the metal element with care since the winding is easily damaged.

**c. Cleaning The Metal Elements.**— Wash the metal elements by shaking them in clean Diesel fuel or dry cleaning solvent. If the sludge must be brushed off, use the soft hair brush 2B4317 and stroke parallel to the winding. Eventually, gums and lacquers may clog the outer elements, even though they appear clean on the outside. The internal condition of an element can be checked by comparing it with a new one. Plug the holes in the bottom of both elements and immerse them to the top rim in Diesel fuel. Compare the rate at which the fuel rises inside the elements. Discard the used one if it is not at least three-fourths full by the time the new one is completely filled.

**d. Replacing The Absorbent Elements.**— Replace the absorbent, inner elements.

**e. Replacing The Cover.**— Replace the cover being sure to seat it properly. After the engine has been started examine for leaks.

**f. Lubrication Order.**— For additional details on the lubricating system refer to the lubrication order, paragraph 33.

## SECTION XXI ELECTRICAL SYSTEM

### 74. GENERAL.

The lighting systems used on the D7 Tractor can be divided into two groups. One group without a battery uses a 75 or 130 watt generator, and the other group with a battery uses a 90 watt generator.

### 75. LIGHTING SYSTEM WITHOUT BATTERY. (See figure 80.)

a. **Generator.**—The generators used without batteries are automatically regulated to provide the amount of current required to operate the lights, within the capacity of the generator.

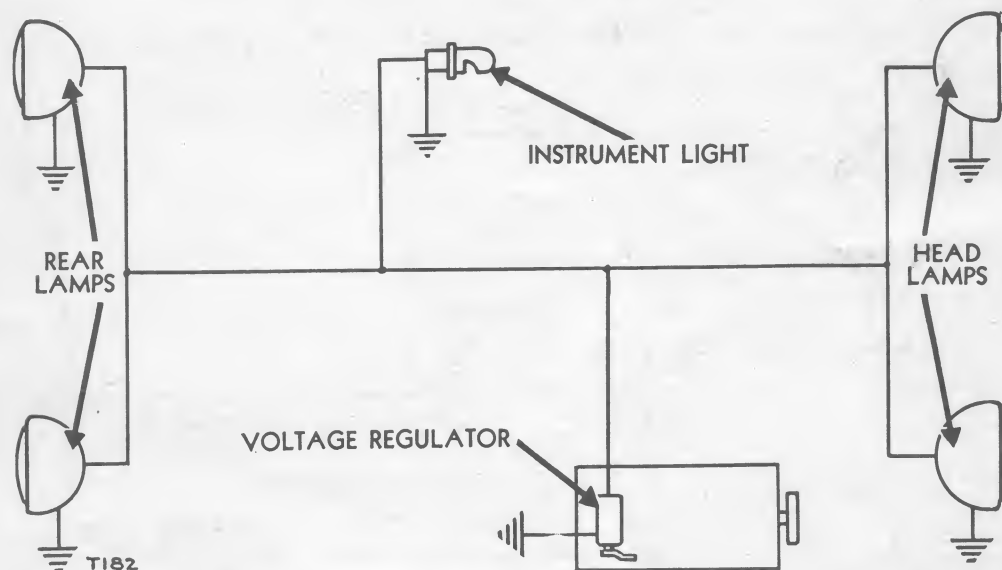


Figure 80—Wiring Diagram Lighting System Without Battery

Generators are plainly marked and those of 75 watt and 130 watt are most commonly used. Mazda bulbs consume approximately 1 watt per candle power. This being the case, it is easy to add up the candle power of the various bulbs in the circuit to determine if the lights in use are within the capacity of the generator. For this reason the generator size should always be checked before deciding to add additional lights or to increase the light intensity by replacing standard bulbs with those of higher candle power.

b. **Regulator.**—The regulator is a combination voltage regulator and light switch and it is mounted on the generator frame. The regulator is properly adjusted at the factory and should not be changed except in



case of failure when both the regulator and generator should be taken to a shop equipped with necessary tools and trained personnel, where the output of the generator can be checked and the regulator adjusted accordingly.¶

## 76. LIGHTING SYSTEM WITH BATTERY. (See figure 81.)

a. **Generator.**—The lighting system with a battery, uses a different type generator and voltage regulator than is used in a lighting system without a battery. The total lighting load may exceed the rated capacity of the generator provided the period of daylight operation is long enough to permit recharging the battery. Never operate a generator with an open circuit between the generator and battery. The lights of this system will light whether the Diesel engine is operating or stopped. The switch for the lights is located on the battery box.

b. **Regulator.**—The regulator for this generator consists of a cut-out relay and a voltage regulator.

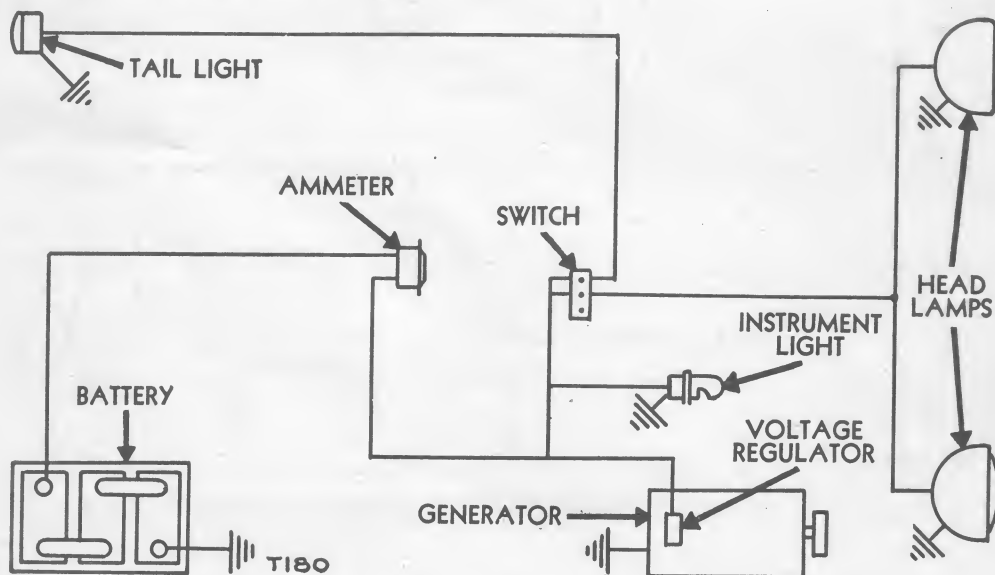


Figure 81—Wiring Diagram Lighting System With Battery

(1) **CUT-OUT RELAY.**—The cut-out relay automatically closes the circuit between the generator and the battery when the generator voltage is sufficient to charge the battery. It also automatically opens the circuit between the generator and the battery when the generator voltage is not sufficient to charge the battery. This prevents the battery from discharging back through the generator windings.

(2) **VOLTAGE REGULATOR.**—The voltage regulator inserts resistance into the generator field to reduce the generator output when the battery becomes fully charged.

## Electrical System

The voltage regulator is properly adjusted at the factory and should not be changed except in case of failure when both the regulator and generator should be taken to a shop equipped with necessary tools and trained personnel, where the output of the generator can be checked and the regulator adjusted accordingly.

If the ammeter does not show a high charging rate, it is not an indication that the equipment is at fault unless the battery shows a low reading when checked with the hydrometer. The regulator permits a heavy flow of current from the generator to the battery only when the battery electrolyte has a low specific gravity. As the battery becomes charged, the ammeter reading decreases proportionately.

**c. Battery.**

(1) BATTERY CHARGE.—The battery should be tested with a hydrometer and kept within a margin of safety to a specific gravity of 1.260 to 1.300.

If it is necessary to add water, charge the battery for a period of time to mix the water and electrolyte before taking a hydrometer reading.

A dangerously low point of charge is indicated by a hydrometer reading of 1.150 which will permit the battery to freeze. A specific gravity of 1.250 will permit the battery to withstand temperature as low as 30°F., without freezing.

(2) BATTERY WATER.—Water that escapes by evaporation should be replaced with distilled water or "approved water" (Water free from impurities by analysis). This level should be maintained  $\frac{3}{8}$  in. above the top of the separators or insulators. Do not overfill or underfill the cells of the battery as either has a detrimental effect on battery life.

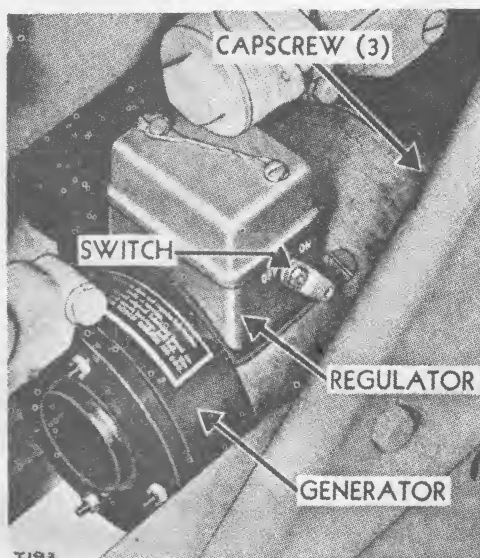
(3) BATTERY TROUBLE.—If when making weekly tests the battery shows evidence of becoming gradually undercharged, it should be removed and completely recharged.

Check to determine the reason for the battery becoming undercharged. Inspect battery terminals and other points in the wiring. A loose connection or worn insulation may be the reason for the battery becoming undercharged. Also have the voltage regulator checked by the proper authority.

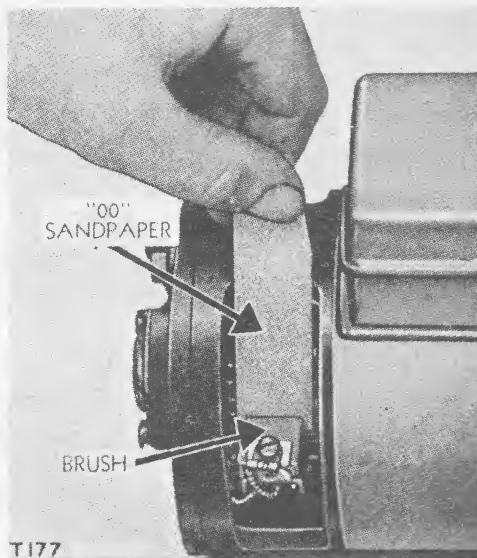
(4) BATTERY TERMINALS.—Keep the top of the battery clean and dry to prevent current losses and keep the terminals clean and tight. To clean corrosion from the battery terminals, scrub them with a weak solution of bicarbonate of soda (baking soda) and water. Dry the battery thoroughly, then coat the terminals with CG to prevent corrosion. Keep the battery securely fastened in its compartment at all times.

## 77. GENERATOR MAINTENANCE.

a. **Removal.**—The generator is located on the right-hand side of the engine, below the hour meter. (See figure 82.) and is attached to the timing gear housing by three capscrews. Disconnect the wire from the terminal block on the regulator. Take out the capscrews and remove the generator.



**Figure 82—Generator Regulator and Switch**



**Figure 83—Seating Brushes With Sandpaper**

b. **Cleaning.**—Every 1,024 hours, the inspection cover should be removed and the commutator checked. If it is glazed or darkened, polish with "00" sandpaper. Never use emery cloth. Clean out all traces of sand particles from the commutator, brushes, and brush holders.

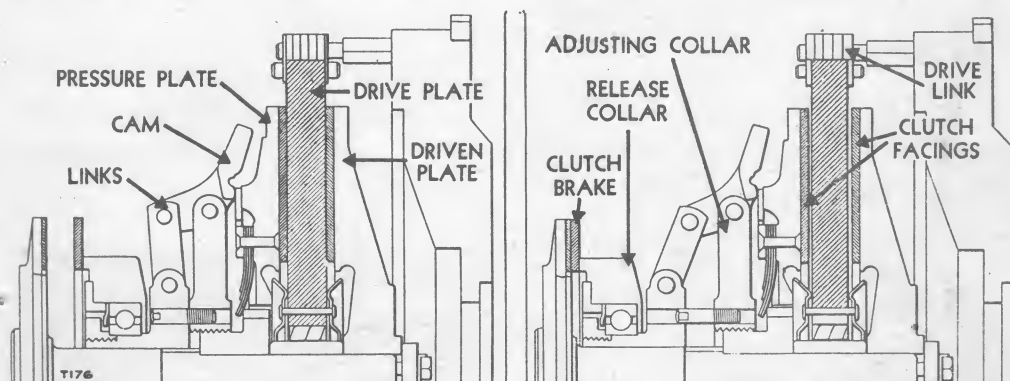
c. **Brush Replacement.**—Brushes should be inspected and replaced if badly worn. When a new brush is installed, seat it properly with the contour of the commutator by using "00" sandpaper. (See figure 83.) Only a second or two is required to do this. Rotate the armature in the normal direction of rotation as the sandpaper is passed between the commutator and the brush. Too much sanding only shortens the life of the brushes. Remove all sand particles and make certain that all the connections are tight.

d. **General Reconditioning.**—Every 4,096 hours, the generator should be removed to be completely disassembled, washed, and have all parts showing evidence of excessive wear replaced. Some generators have the bearings packed with a high melting point lubricant making lubrication necessary only when the generator is disassembled for cleaning or repair.

## SECTION XXII FLYWHEEL CLUTCH

### 78. DESCRIPTION. (See figure 84.)

The flywheel clutch is of the dry, plate, snap-over center type. The flywheel clutch drive plate is connected to the flywheel by means of flexible drive links. The pressure plate and driven plate, lined with metallic facings, are attached to a stub shaft connected to the trans-



**Figure 84—Flywheel Clutch Engaged and Disengaged**

mission upper shaft. When the clutch is engaged a toggle mechanism consisting of spring links and cams pushes the pressure plate against the drive plate and it in turn presses against the driven plate. When the drive plate is gripped by the pressure plates the turning effort of the engine is transmitted to the transmission. The clutch automatically stays engaged when the spring links snap over center.

A brake is provided to bring the rotating clutch and transmission shafts to a stop when the clutch is disengaged and the lever pushed forward. This makes it possible to shift gears without clashing them. The brake pressure plate is attached to the release collar and presses against the revolving brake disc when the clutch control lever is in the extreme released position.

### 79. CARE.

As the flywheel clutch facings wear and become thinner the distance between the pressure plate and driven plate must be decreased by adjustment, to prevent the clutch from slipping. In those tractors with enclosed type clutches any accumulated oil must be drained by removing a plug in the bottom of the flywheel housing. This plug and the compartment cover must be kept in place to prevent moisture and dirt from entering the clutch compartment. Flywheel clutch lubrication is covered in the lubrication order paragraph 33.

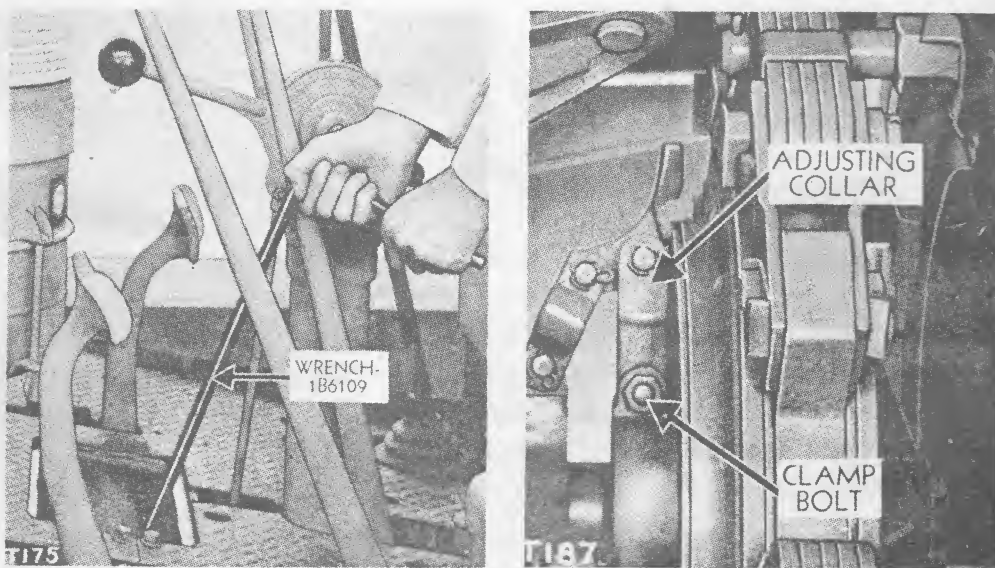
## 80. ADJUSTMENT.

a. **General.**—The clutch is correctly adjusted when the clutch control lever requires a reasonably hard pull and the clutch engages with a distinct snap. The flywheel clutch adjustment must be made with the engine stopped and the clutch disengaged.

The length of the adjustable rod between the flywheel clutch control lever and the crank that actuates the clutch yoke should not be changed, as its length has a definite bearing on the satisfactory operation of the gear shift interlock mechanism.

### b. Procedure.

(1) **STOP THE ENGINE.**—Stop the engine by pushing the throttle control lever forward in the “SHUT OFF” position. Never attempt to adjust the clutch when the engine is running.



**Figure 85—Adjusting Flywheel Clutch**

(2) **DISENGAGE THE FLYWHEEL CLUTCH.**—Disengage the flywheel clutch by pushing the clutch control lever forward.

(3) **REMOVE INSPECTION COVER.**—On tractors with the enclosed type clutch, effective with serial number 7M4325, remove the inspection cover on top of the clutch housing. On tractors below 7M4325 remove a floor plate section located below the air cleaner.

(4) **LOCATE THE CLAMP BOLT.**—With the transmission gears disengaged, turn the adjusting collar until the nut on the adjusting collar clamp bolt is in a position to loosen through the inspection opening. (See figure 85.)



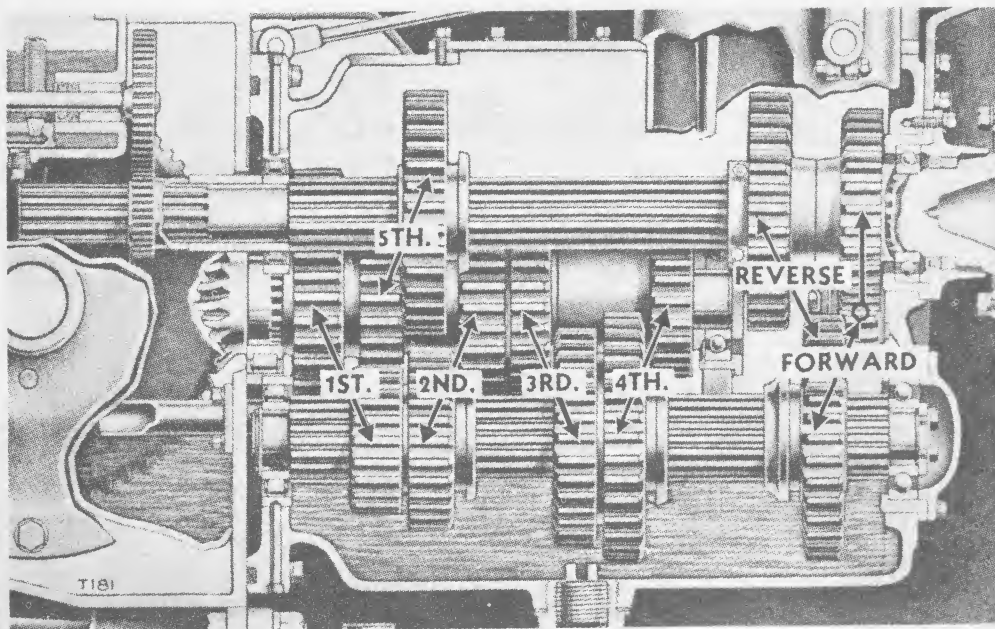
## Transmission

- (5) **ENGAGE TRANSMISSION GEARS.**—Engage the transmission gears to prevent the clutch shaft from turning.
- (6) **LOOSEN NUT ON ADJUSTING COLLAR CLAMP BOLT.**—Loosen the nut on the adjusting collar clamp bolt with wrench No. 1B6109. (See figure 85.)
- (7) **TURN ADJUSTING COLLAR.**—Turn the adjusting collar a few degrees in a clockwise direction to tighten.
- (8) **DISENGAGE TRANSMISSION GEARS.**—As the adjusting collar is turned to adjust it is turned on the shaft. By disengaging the transmission, the shaft can be turned back with the adjusting collar to put the collar clamp nut in position to tighten without altering the adjustment.
- (9) **TIGHTEN NUT ON COLLAR CLAMP BOLT.**—Tighten the nut on the collar clamp bolt with wrench No. 1B6109. Be sure the clutch is disengaged at the time this nut is tightened so that the adjusting collar will grip the hub tightly.
- (10) **CHECK ADJUSTMENT.**—Check the adjustment by pulling the clutch control lever and repeat the above procedure until the desired clutch snap is obtained.
- (11) **REPLACE INSPECTION COVER.**—Replace the inspection cover on tractors with the enclosed clutch, or the floor plate section on tractors with the exposed type clutch.

## SECTION XXIII TRANSMISSION

### 81. GENERAL DESCRIPTION.

The transmission consists of a gear case and its gears with which the various speeds for the tractor are selected, the gear shift mechanism to shift the gears to select the various speeds and an interlock mechanism to prevent the gears from sliding out of position. The transmission is lubricated with lubricant put in through a filler hole in the top of the gear shift housing, to a level indicated on a bayonet gage extending down into the transmission case. The oil in the bevel gear compartment adjusts itself to that level through a connecting tube.



**Figure 86—Transmission Gears and Speed Change Positions**

## **82. GEAR CASE.**

a. **Description.** (See figure 86.)—The transmission gear case is attached to the bevel gear compartment on the forward side of the steering clutch case. The upper transmission shaft is connected to the clutch shaft and rotates constantly while the flywheel clutch is engaged. The power comes in through the upper shaft, through the forward idler or the reverse gear to the lower shaft and through its sliding gears to the pinion shaft, for the “FIRST,” “SECOND,” “THIRD,” and “FOURTH” speeds. The “FIFTH” speed is obtained by shifting the sliding gear on the upper transmission shaft into its mating gear on the pinion shaft.

b. **Care.**—The upper shaft, its bearings and gears depend upon the oil carried up by the lower transmission gears for lubrication, therefore, it is necessary when the tractor is used in “FIFTH” gear that the direction change lever be engaged in the forward direction position. This will keep the lower transmission gears rotating to circulate the lubricant. Lubrication and flushing details are covered in paragraphs 33. and 34.

## **83. GEAR SHIFT MECHANISM.**

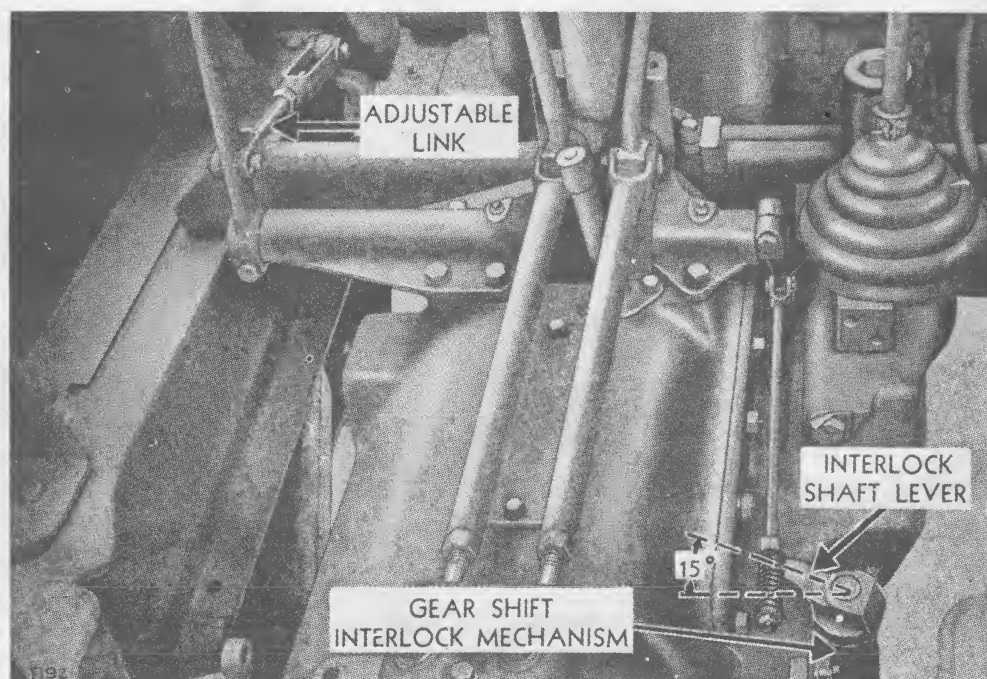
The gear shift mechanism with its four shifter forks and two gear shift control levers is attached to the right side of the transmission case. By moving the two gear shift control levers combinations of gears may be selected to give five forward and four reverse speeds. The forward or reverse direction is selected by one lever, the other lever is used to select the desired speed for either forward or reverse.

**84. GEAR SHIFT INTERLOCK MECHANISM.** (See figure 87.)

a. **Description.**—The gear shift interlock mechanism, attached to the right side of the gear shift housing, holds the shifter forks and transmission gears in position when the flywheel clutch is engaged. The mechanism consists of spring loaded plungers which fit into notches on the shifter shafts and an interlock shaft which is connected by a lever and a rod to the flywheel clutch control lever. The interlock shaft acts as a cam to lock the plungers in the notches in the shifter shafts when the flywheel clutch is engaged, thereby preventing the transmission gears from sliding out of position when the flywheel clutch is engaged. When the flywheel clutch is disengaged, the interlock shaft is rotated, allowing the plungers to be forced out of the notches as the gears are shifted.

b. **Adjustment.**

(1) **GENERAL.**—If the adjustable link is too long the interlock mechanism will not release, if the link is too short the interlock mechanism will not lock the shifter forks when the flywheel clutch is engaged.



**Figure 87—Interlock Mechanism and Adjustment**

(2) **PROCEDURE.**

(a) **REMOVE FLOOR PLATES.**— Remove the floor plates to expose the interlock mechanism and the adjustable link.

(b) **ENGAGE THE FLYWHEEL CLUTCH.**—When the flywheel clutch is engaged the interlock shaft lever should be forward approximately  $15^{\circ}$  from a line perpendicular to the side of the transmission. When the clutch is released the lever should be approximately perpendicular to the side of the transmission.

(c) **ADJUST THE LINK.**—If the adjustment is incorrect, loosen the lock nut on the adjustable link, remove the pin and turn the yoke in or out until the interlock shaft lever is in the position described above.

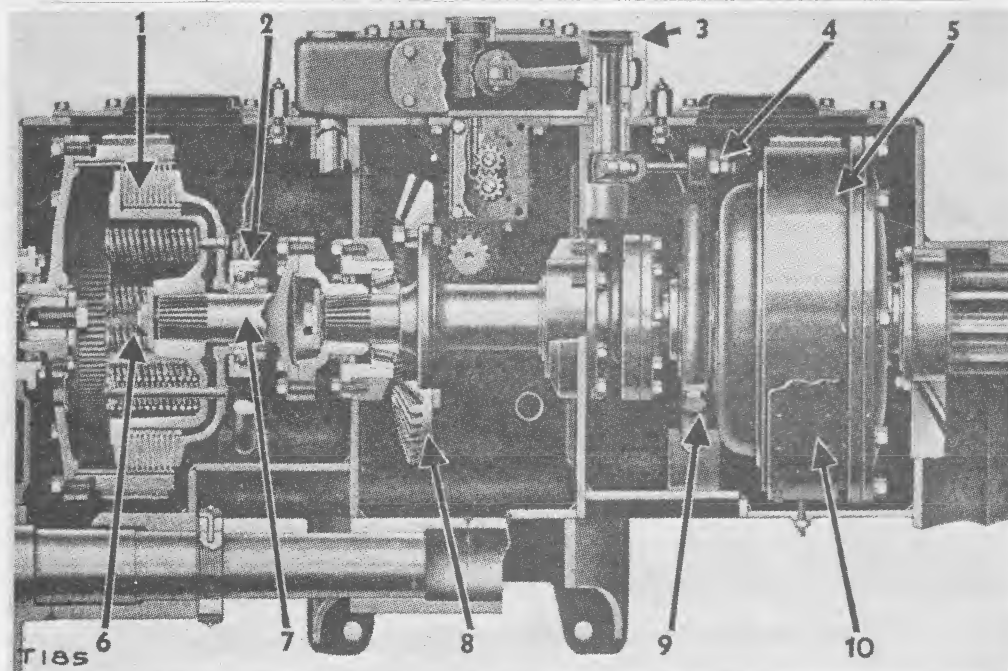
(d) **CHECK ADJUSTMENT.**—When the clutch is disengaged it should be possible to shift the gears. When the clutch is engaged it should be impossible to shift the gears.

## SECTION XXIV

### STEERING CLUTCHES

#### 85. DESCRIPTION. (See figure 88.)

The steering clutches are located in separate compartments on each side of the bevel gear. The clutches are of the dry, multiple disc type, held in engagement by springs.



- |                      |                 |
|----------------------|-----------------|
| 1. CLUTCH DISCS      | 6. SPRINGS      |
| 2. RELEASE BEARING   | 7. CLUTCH SHAFT |
| 3. HYDRAULIC CONTROL | 8. BEVEL GEAR   |
| 4. ADJUSTING NUTS    | 9. RELEASE YOKE |
| 5. OUTER DRUM        | 10. BRAKE BAND  |

**Figure 88—Steering Clutches and Bevel Gear**

## Steering Clutches

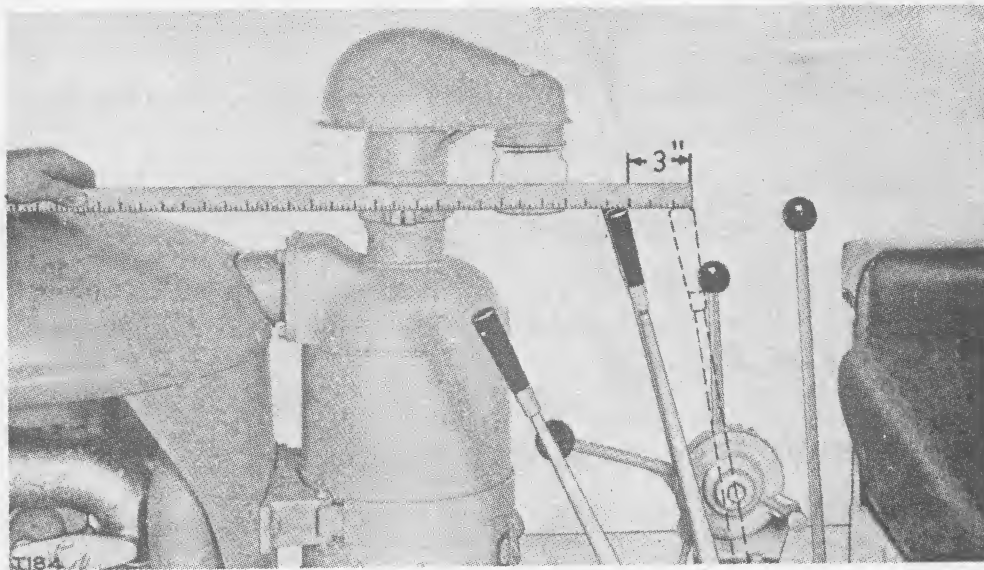
### 86. CARE.

The steering clutches are designed to operate dry. Lubricant is used only to lubricate the release bearings. This lubricant and any seepage from adjoining compartments should be drained regularly by removing the plugs from the bottom of the case. Drain plugs must be kept in place while operating to prevent dirt and water from entering the compartments.

### 87. ADJUSTMENT.

a. **General.**— Before checking the adjustment stop the engine and make sure there is no obstruction between the steering clutch control levers and the bumper blocks. (See figure 92.)

b. **Correct Adjustment.** (See figure 89.)—The adjustment is correct when there is three inches of free movement at the top of the steering clutch control levers. This free movement becomes less as the clutch facings wear and it is necessary to restore it by adjustment so that the clutches will fully engage.

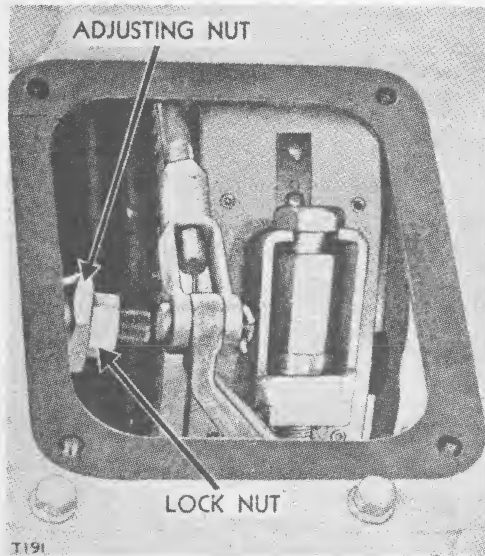


**Figure 89—Correct Steering Clutch Lever Free Movement**

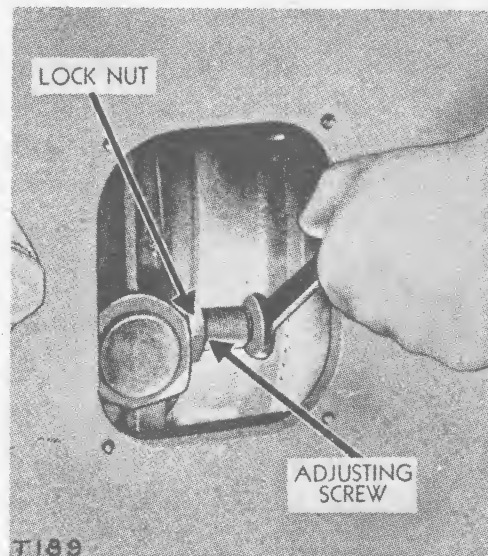
c. **Adjustment Procedure on Tractors Above 7M5054.** (See figure 90.)

(1) Remove the plate across the back of the steering clutch case below the fuel tank and take off the two small plates (one for each clutch) located on top of the steering clutch case.





**Figure 90—Steering Clutch Adjustment Above 7M5054**



**Figure 91—Steering Clutch Adjustment Below 7M5054**

(2) Loosen the lock nut and turn the adjusting nut until the correct clutch lever free play of three inches is obtained. Make the adjustment on both clutches.

d. **Adjustment Procedure on Tractors Below 7M5054.** (See figure 91.)

(1) Remove the two plates on the back face of the steering clutch case, one on each side of the power take-off opening.

(2) Loosen the lock nut and turn the adjusting screw until the correct clutch lever free play of three inches is obtained. Make the adjustment on both clutches.

## **88. STEERING CLUTCH HYDRAULIC CONTROL UNIT.**

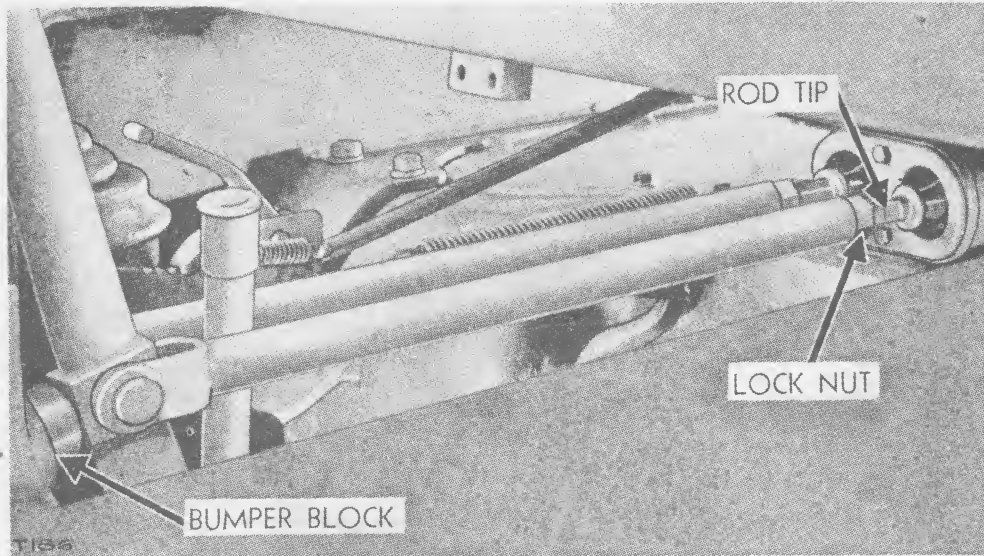
a. **Description.**—The hydraulic control unit mounted on top of the steering clutch case releases the steering clutches when the operator exerts a light pull on the steering clutch levers.

The oil pressure pump in the unit is driven by the upper transmission shaft. If the unit fails for any reason the tractor may be manually controlled by the steering clutch levers.

b. **Care.**—Be sure to keep dirt out of the unit. Before checking the oil level brush all dirt away from the filler plug and opening.

c. **Adjustment.** (See figure 92.)

## Steering Clutch Brakes



**Figure 92 Adjustment of Steering Clutch Control Rod**

- (1) There should be approximately 1/32 inch between the tip of each rod connected to the steering clutch control lever and the push rod in the front end of the hydraulic control mechanism when the control lever is against the bumper block.
- (2) To adjust the rod, loosen the lock nut and turn the tip of the rod until the clearance is correct. Tighten the lock nut and recheck the clearance.

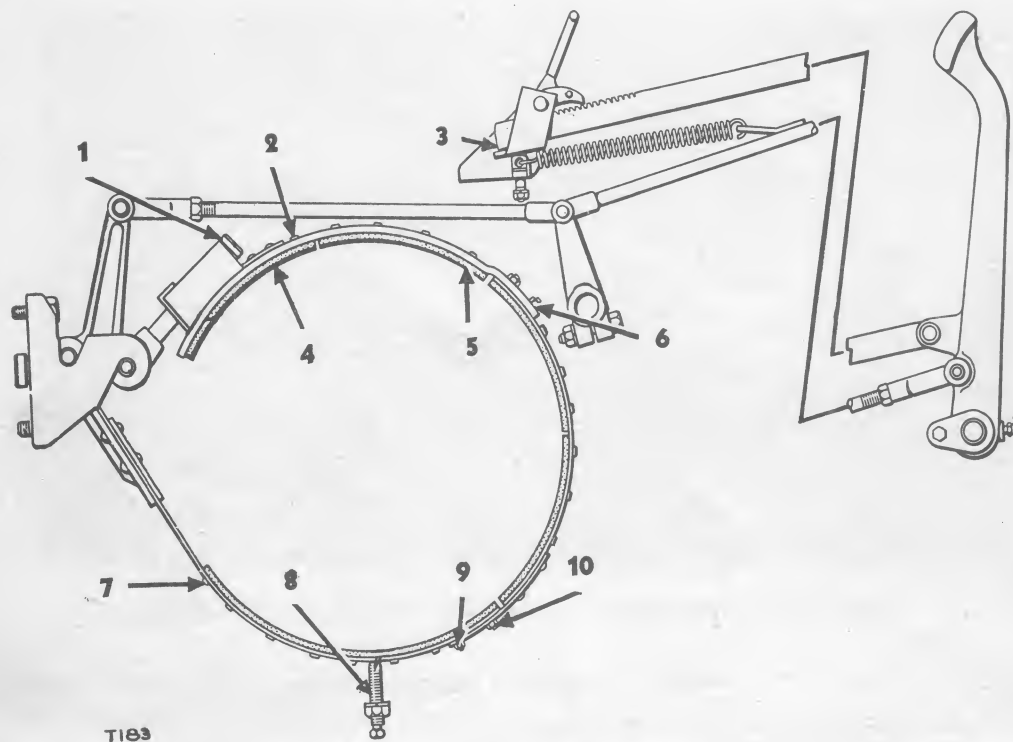
## SECTION XXV STEERING CLUTCH BRAKES

### 89. DESCRIPTION. (See figure 93.)

Two separate foot brakes are used to supplement the action of the steering clutches or to stop the tractor. Each pedal operates a self-energizing brake band on the steering clutch outer drum. The right hand brake has a hand-operated lock to set the brake in a locked position to hold the tractor on slopes or when doing stationary work. A supporting screw located on the under side of the steering clutch case supports the band and maintains the correct clearance between the band and the brake drum.

### 90. CARE.

The steering clutch brakes should be kept correctly adjusted and used only when necessary. The linings should be replaced before they are worn down to the rivet heads that hold them to the bands, to prevent damaging the brake drum.



1. ADJUSTING NUT  
2. RIVET (28) 7B5054  
3. LOCK ASSEMBLY

4. LINING (8) 8B832  
5. LINING (4) 8B831  
6. BOLTS (12) 6B9286  
10. NUTS (48) 1B4202

7. RIVET (64) 7B5050  
8. SUPPORT SCREW  
9. BOLTS (12) 8B9519

**Figure 93—Brake Mechanism**

## 91. ADJUSTMENT.

a. **General.**—Keep the brakes adjusted just tight enough so the tractor will turn correctly when the steering clutch is released and the brake pedal is pressed down three-fourths of the way to the floor plate. The band should be entirely free from the drum when the pedal is released.

### b. Procedure.

- (1) **REMOVE INSPECTION PLATE.**—Remove the four capscrews and lift off the inspection plates (one for each brake) immediately back of the seat and on top of the steering clutch case.
- (2) **TURN ADJUSTING NUT.** (See figure 94.)—Turn the adjusting nut clockwise to tighten, until the correct adjustment is obtained.
- (3) **ADJUST SUPPORT SCREWS.** (See figure 95.)—Loosen the support screw lock nuts on the underside of the steering clutch case. Apply each brake and turn each supporting screw up snug against the band. Then turn each screw back  $1\frac{1}{2}$  turns and tighten the lock nuts.

# Steering Clutch Brakes



**Figure 94—Turning Brake Adjusting Screw**



**Figure 95—Turning Brake Band Support Screw**

(4) **REPLACE INSPECTION PLATE.**— Replace the inspection plate using a new gasket if the old one is defective.

## 92. BRAKE BAND REMOVAL. (See figure 96.)

a. **Remove The Large Cover Over The Steering Clutch Compartment.**— Clean all dirt from the top of the steering clutch case and remove the large cover over the steering clutch compartment.

b. **Remove Brake Rod.**— Disconnect the brake rod, (inside the case) at both ends by removing the pins and lift it out.

c. **Remove Support Screw.**— Remove the support screw on the under side of the steering clutch case.

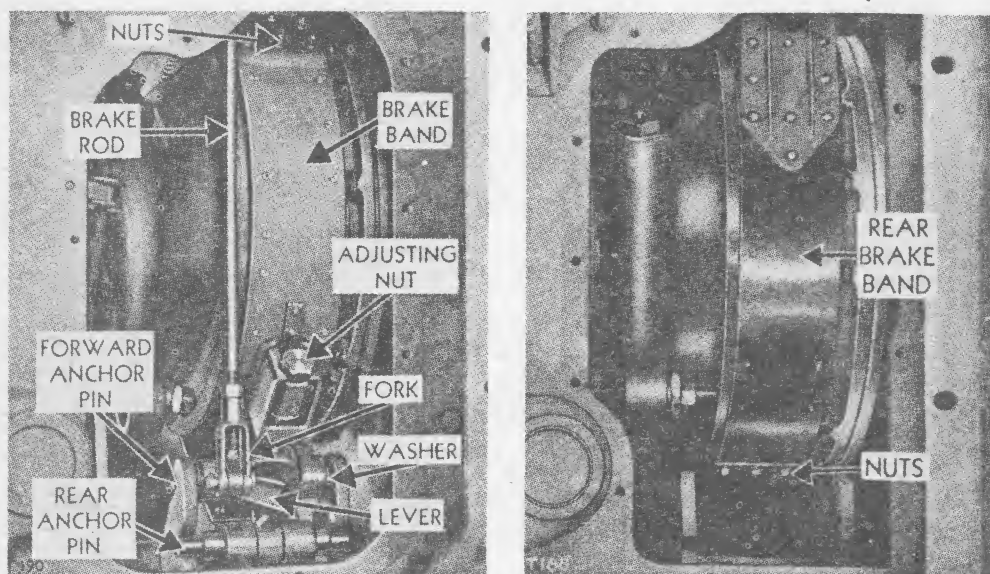
d. **Remove Adjusting Nut.**— Remove the adjusting nut by turning it counterclockwise.

e. **Remove Rear Anchor Pin.**— Rotate the lever forward about the forward anchor pin and remove the rear anchor pin.

f. **Remove Forward Anchor Pin.**— Slide out the forward anchor pin and lift out the lever, fork and the two washers.

g. **Remove Top Section Of Brake Band.**— Remove the nuts that hold the top section of the band to the forward section and remove the top section.

h. **Remove Rear And Forward Section.**— Rotate the band around the drum and remove the nuts that hold the rear and forward sections of the band together and remove the sections.



**Figure 96—Replacing Brake Bands**

i. **Remove Linings From Bands.**— Drive out the rivets that hold the linings to the band with a small punch, taking care not to bend the band.

j. **Brake Drums.**— If brake drums are scored or badly worn report to the proper authority.

### **93. INSTALLATION.**

a. **Replace Linings.**— Rivet the linings on the bands with brass rivets.

b. **Install Bands.**— Install bands in the reverse order of removal and securely tighten the nuts that hold the bands together. Care should be taken not to drop anything in the compartment.

c. **Install Forward Anchor Pin.**— Slide the anchor pin in connecting the fork and lever. Place the washers on each end of the pin between the anchor and the fork.

d. **Install Rear Anchor Pin.**— Rotate the band forward and insert the rear anchor pin.

e. **Start Adjusting Nut On Fork.**

f. **Connect Brake Rod.**

g. **Adjust Brakes, Install And Adjust Supporting Screw.**

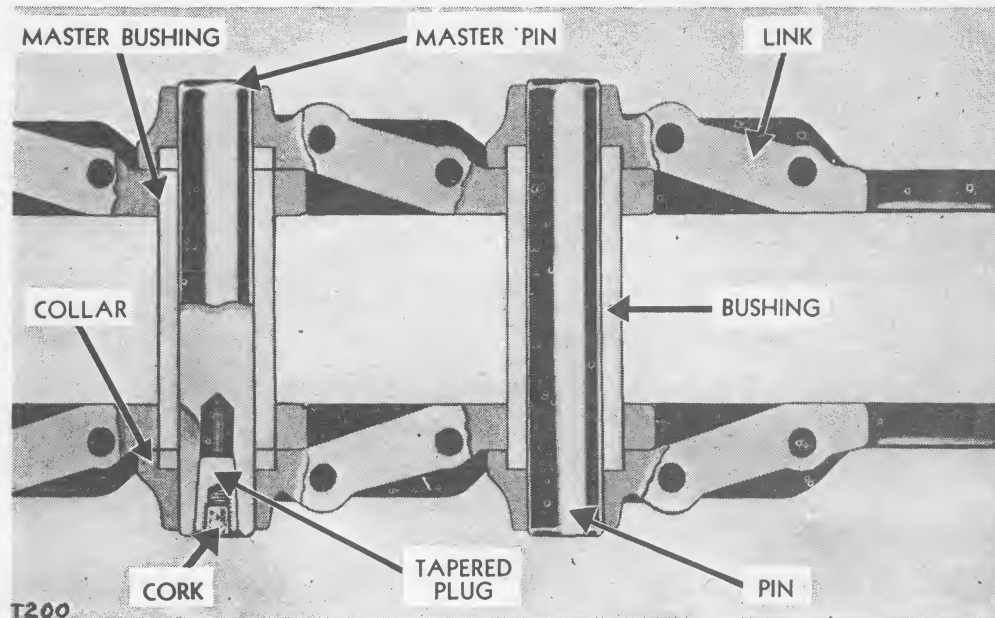
h. **Install Steering Clutch Compartment Cover.**



## SECTION XXVI TRACKS

### 94. DESCRIPTION. (See figure 97.)

The track link assembly consists of links, pins and bushings. Each link overlaps the preceding link thus forming a continuous chain. Each



**Figure 97—Track Link Assembly**

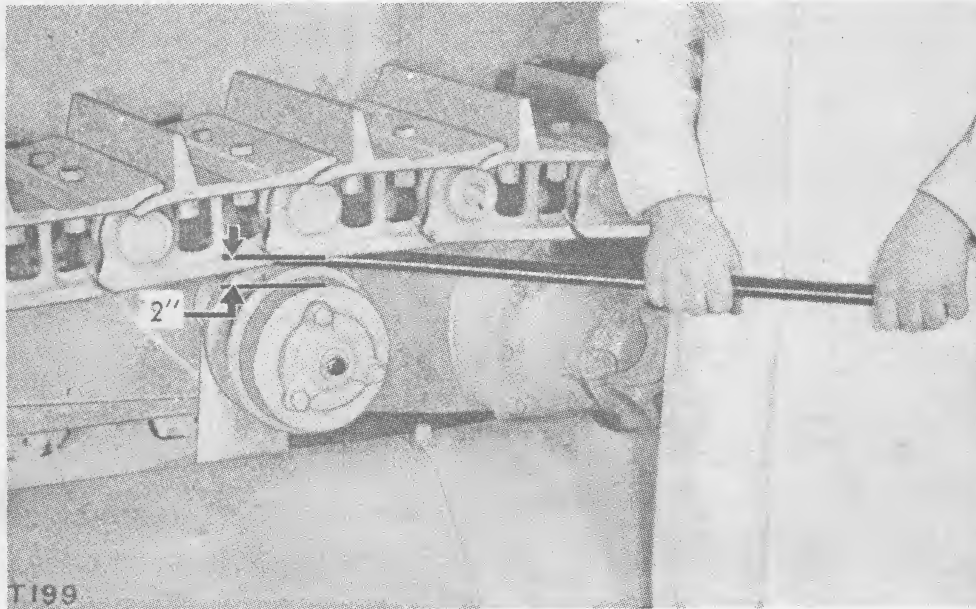
link is counterbored in the overlapped portion to provide a tight joint, and reduce the entrance of abrasives. The bushings are all alike except the master bushing which is shorter for assembly purposes. With the master bushing, collars are inserted in the counterbored space. The pins are alike except the master pin which is taper reamed and split at each end. This construction permits a tapered plug to be driven into each end of the master pin to hold it in position in the links. A cork inserted in the tapered plug protects the threads in the plug. The standard pins and bushings are pressed into the links, therefore, it requires a heavy duty press to remove them. Each track shoe is attached securely to the links by four steel bolts and double length nuts.

### 95. CARE.

It is essential that the track be in correct adjustment for the condition in which the tractor is working. Check the track shoe bolts at regular intervals and tighten them if any become loose.

## 96. ADJUSTMENT.

a. **General.**—The track adjustment is normally correct when the track may be raised from  $1\frac{1}{2}$  to 2 inches above the track carrier roller with a bar. (See figure 98.) When operating in loose material which may pick up and clog the tracks, loosen the track adjustment. Experience will show when it is necessary to change the adjustment from normal.



**Figure 98—Correct Track Adjustment**

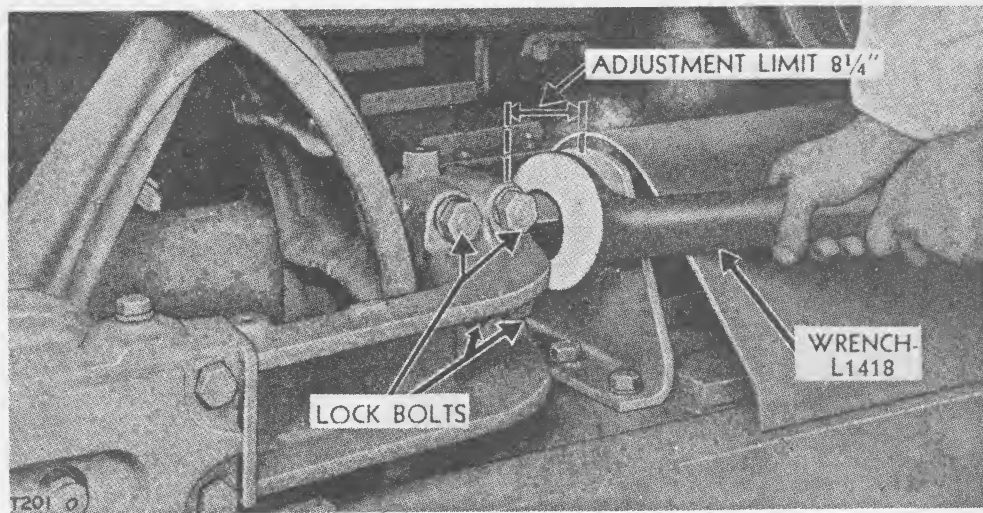
### b. **Adjusting Procedure.** (See figure 99.)

(1) **REMOVE TRACK ADJUSTING SCREW GUARD.**— Remove the three capscrews that hold the track adjusting screw guard in place, immediately back of the front idler.

(2) **LOOSEN CLAMP BOLTS.**— Loosen the clamp bolts that clamp the idler arms to the adjusting screw. Tractors beginning with 7M6396 have four clamp bolts and tractors before 7M6396 have only two.

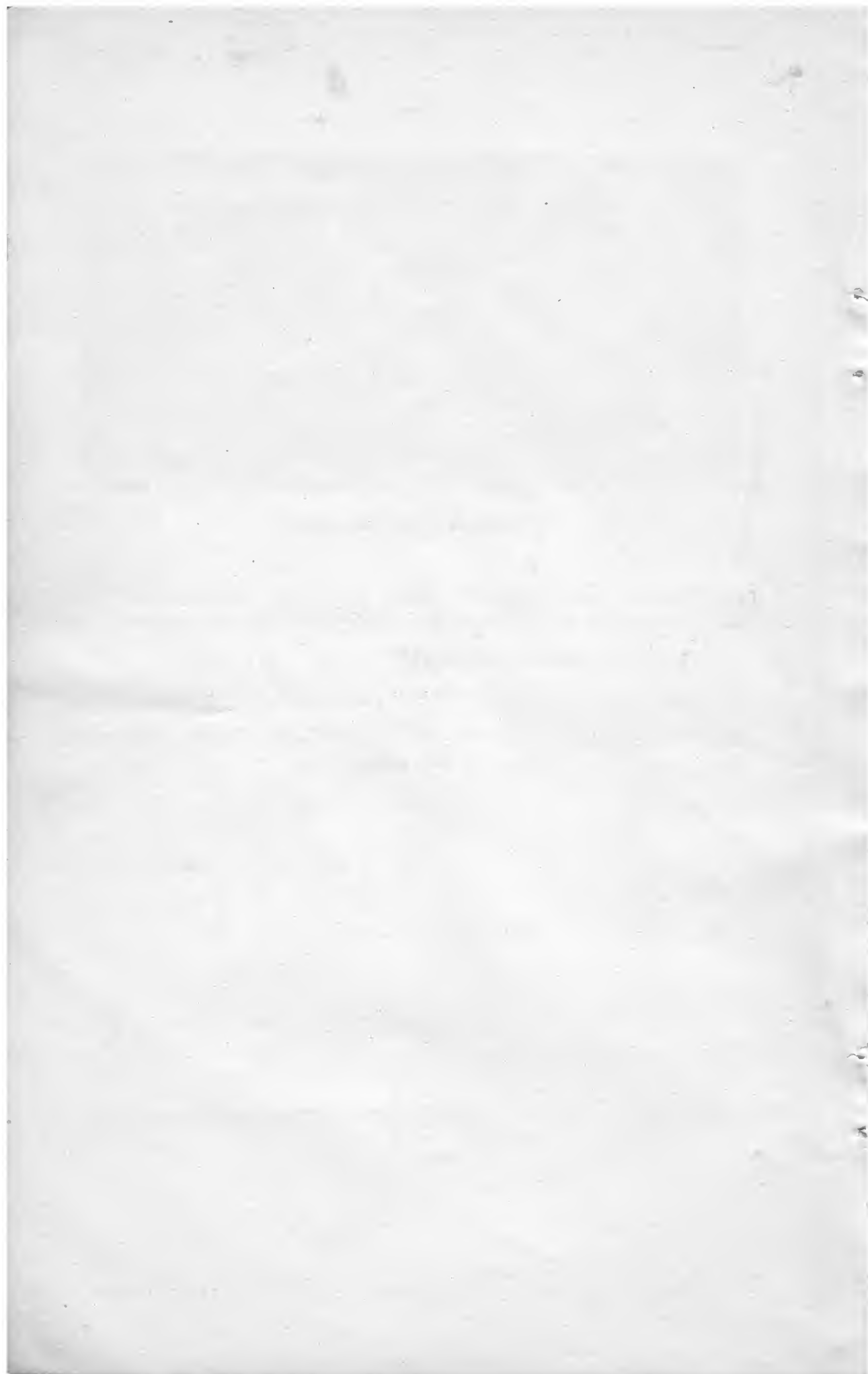
(3) **TURN ADJUSTING SCREW.**— Turn the adjusting screw using wrench No. L1418 until the desired tension on the track is obtained. As continued track adjustment becomes necessary through service, the adjusting screw is screwed out of the nut at the front end of the recoil spring. Do not exceed the maximum measurement of  $8\frac{1}{4}$  inches between the face of the adjusting screw guide and the face of the idler arms to prevent damage to the adjusting screw and nut. Report to the proper authority when this measurement is reached.

Tracks



**Figure 99—Adjusting Track**

- (4) **CHECK ADJUSTMENT.**—Drive the tractor backward and forward to equalize the track tension and recheck the adjustment.
- (5) **TIGHTEN THE CLAMP NUTS.**
- (6) **REPLACE THE TRACK ADJUSTING SCREW GUARD.**
- (7) **REPEAT ADJUSTMENT ON THE OTHER TRACK.**—The track tension should be the same on both tracks.



## **PART FOUR AUXILIARY EQUIPMENT**

### **SECTION XXVII GENERAL**

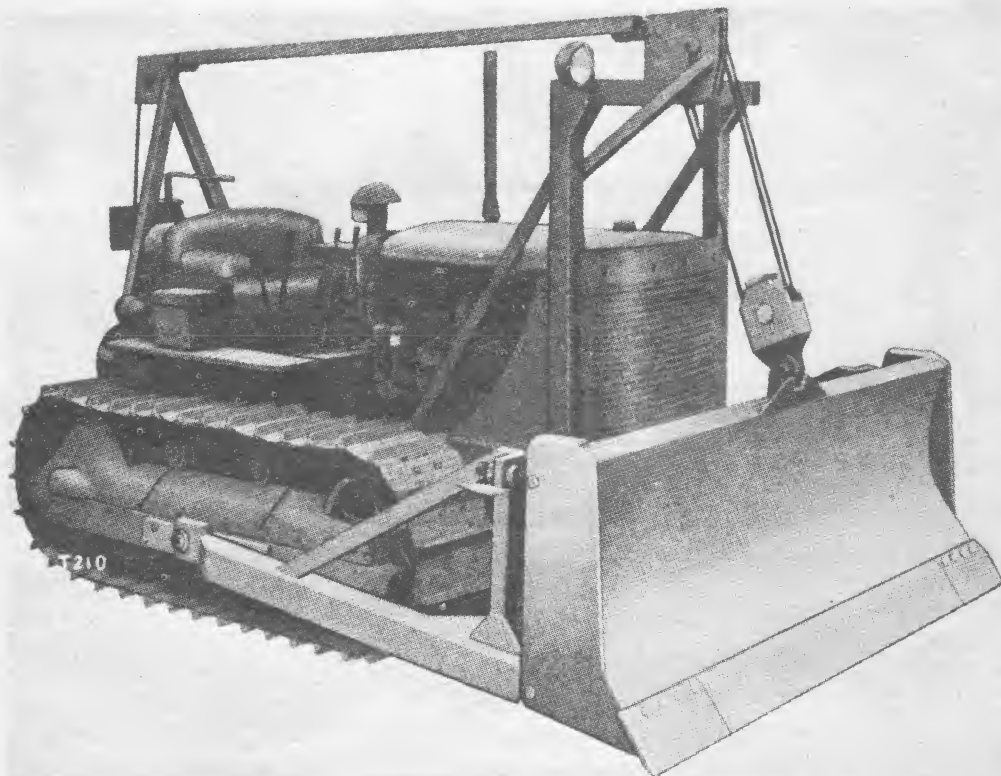
#### **97. SCOPE.**

Part four contains information and illustrations intended to help using personnel to properly identify auxiliary equipment. Detailed instructions pertaining to this auxiliary equipment is contained in separate technical manuals which are listed in the reference section at the end of the book.

### **SECTION XXVIII AUXILIARY EQUIPMENT**

#### **98. BULLDOZERS.** *(See figure 100.)*

Bulldozers are widely used earth moving tools. They are used to pioneer trails through hilly, mountainous country or dense jungle, clear right-of-way for roads, airports, camp sites, reservoirs and similar projects.

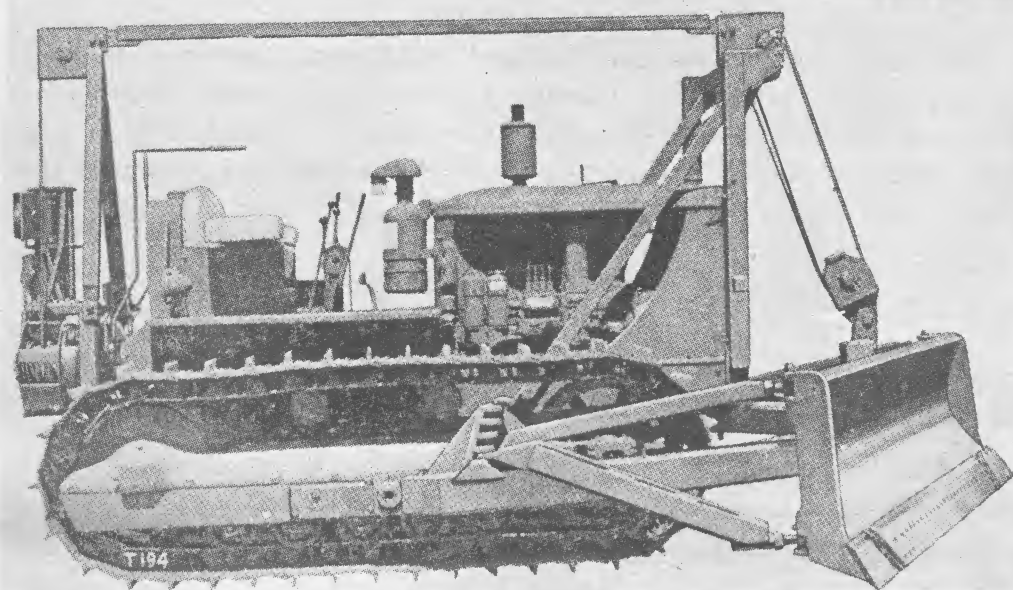


**Figure 100—D7 Tractor Equipped with LeTourneau XD7 Bulldozer**

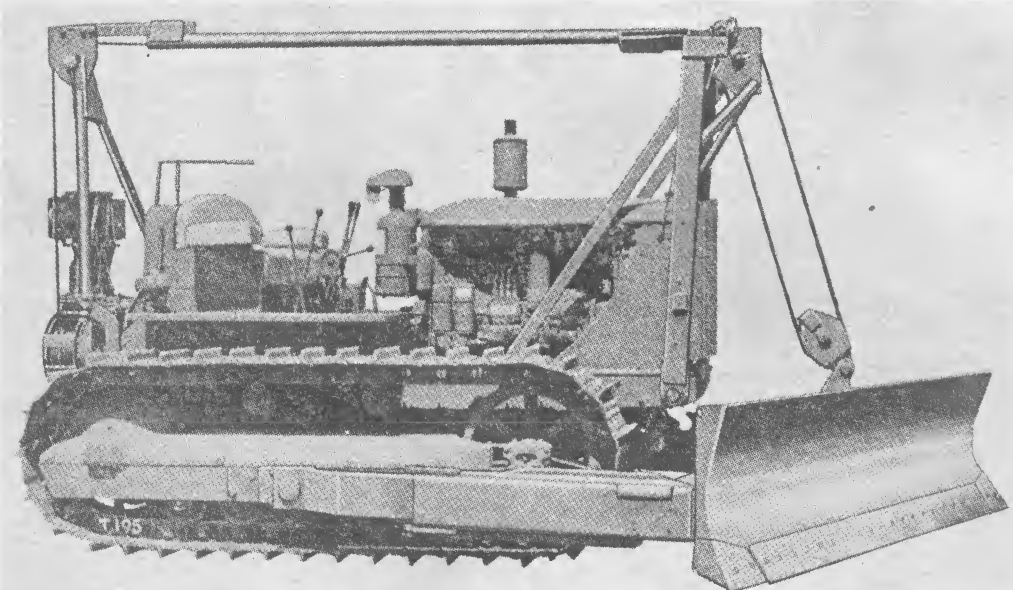


**99. ANGLEDZOZER (LeTOURNEAU) (LaPLANT-CHOATE.)** (See figures 101, 102, 103, and 104.)

Angledozerers are similar to bulldozers but blade angling and tilting features are added. The blade may be angled to the right or left and either corner of the blade may be tilted below the other end.

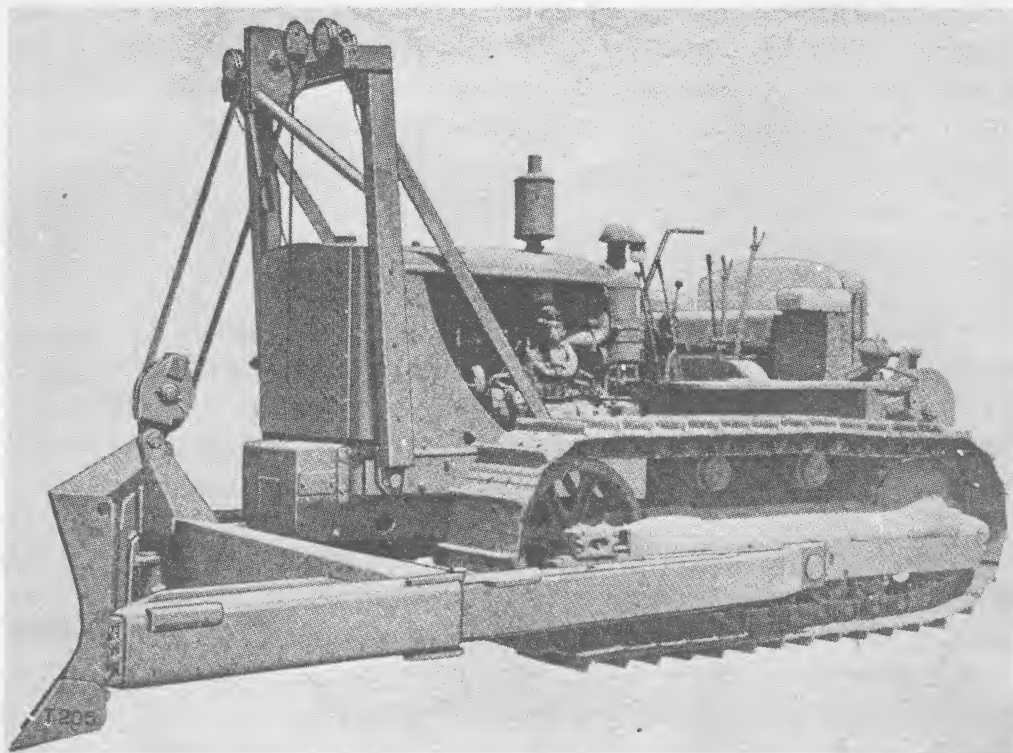


**Figure 101—D7 Tractor Equipped with LeTourneau WCK7 Angledozer Controlled by R7 Power Control Unit**

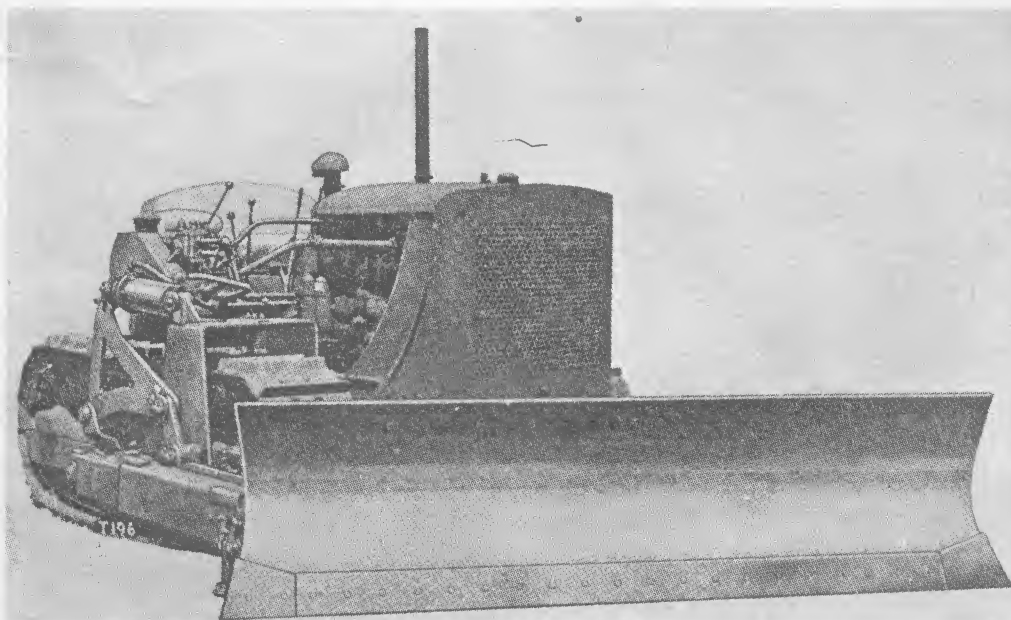


**Figure 102—D7 Tractor Equipped with LaPlant-Choate R76R Angledozer LeTourneau R7 Power Control Unit**

Auxiliary Equipment



**Figure 103—D7 Tractor Equipped with LaPlant-Choate R76F Angledozer  
LeTourneau FTD7 Power Control Unit**



**Figure 104—D7 Tractor Equipped with LaPlant-Choate R71 Angledozer  
Hydraulic Control**

The angledozer can be used in the bulldozing position or, when desired can easily be angled for sidecasting and for opening certain types of side hill cuts. LeTourneau angledozers are cable controlled. LaPlant-Choate angledozers are either cable or hydraulic controlled.

## 100. POWER CONTROL UNITS.

a. **General.**—A power control unit utilizes tractor power to raise or lower dozer blades or operate cable controlled scrapers. Power controls are roughly divided into two types. Front mounted, driven by the front power take-off and rear mounted, driven by the transmission power take-off.

b. **Front Mounted Power Control Unit.** (See figure 106.)—The front mounted power control unit is attached to the main tractor frame in front of the radiator, and is driven by the crankshaft of the engine. It is only used to operate a dozer and can be used in conjunction with a rear mounted cable control unit or a towing winch.

c. **Rear Mounted Power Control Unit.** (See figure 105.)—The rear mounted power control unit is mounted on the rear of the steering clutch case and is driven by the upper transmission shaft. In addition to operating a dozer the rear cable control unit is used to operate scrapers, and any other cable controlled equipment.

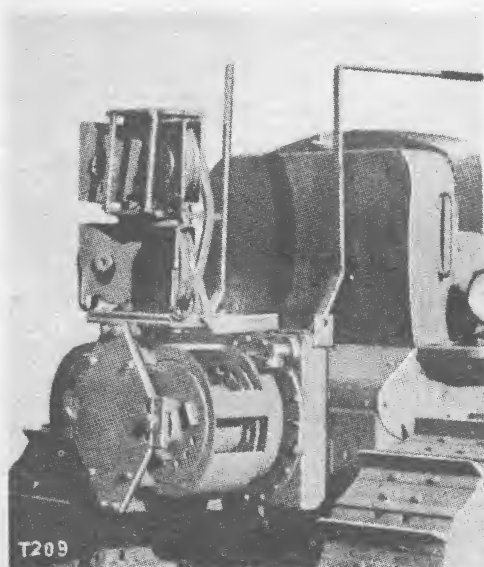


Figure 105—LeTourneau R7 Power Control Unit

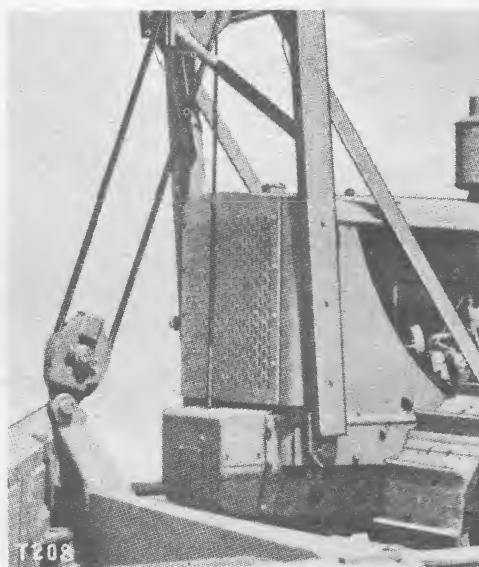
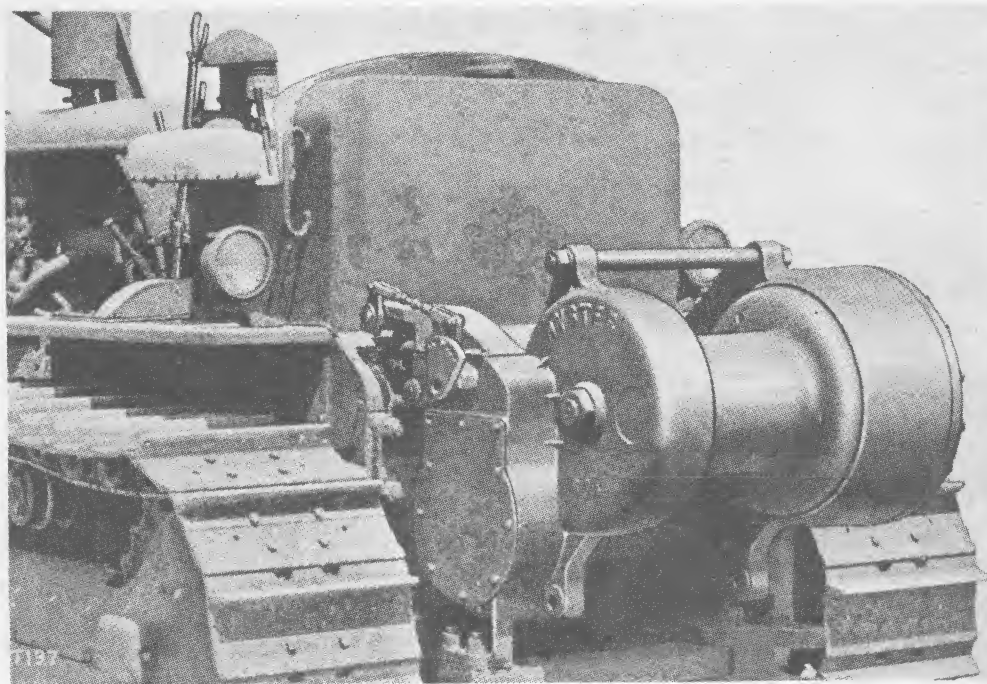


Figure 106—LeTourneau FTD7 Power Control Unit

Auxiliary Equipment



**Figure 107—Hyster D7N Winch**

**101. WINCH.** (See figure 107.)

The Hyster D7N towing winch is designed to utilize the engine power in the form of line pull for loads in excess of those which can be conveniently handled on the tractor drawbar.

## APPENDIX

### SECTION XXIX SHIPMENT AND STORAGE

#### 102. SHIPMENT.

a. **General.**—The common means of shipping large tractors are by truck, trailer, or flat car. The type of conveyance used should have ample strength to carry the load. For approximate weights of different combinations of equipment, see paragraph 5. Regardless of the type of conveyance used, the following steps should be followed in preparing the tractor for shipment.

#### b. Domestic Shipping.

(1) PLACE TRACTOR SQUARE ON TRUCK BED OR CAR FLOOR.—Place the tractor square on the truck bed or car floor and see that the tracks have solid footing for the full length of the tracks.

(2) PLACE THE THROTTLE CONTROL LEVER IN SHUT-OFF POSITION.

(3) PLACE THE COMPRESSION RELEASE IN RUN POSITION.

(4) SHIFT THE TRANSMISSION IN FIRST SPEED.

(5) ENGAGE THE FLYWHEEL CLUTCH.

(6) LOCK THE BRAKE PEDAL IN THE "APPLIED" POSITION.

(7) COVER THE EXHAUST PIPE.

(8) PLACE CHOCKS IN FRONT AND BACK OF BOTH TRACKS.

(See figure 108.)—If the tractor is to be shipped by flat car, place chocks as close together as possible in such a position as to prevent any forward or backward motion of the tractor. Fasten the chocks to the floor of the flat car with spikes or some equally effective method.

(9) PLACE A TWO × FOUR INCH TIMBER ALONG THE OUTSIDE EDGE OF BOTH TRACKS.—Along the outside edge of both tracks, spike a two × four inch timber to the car floor to prevent side shift of the tractor. (See figure 108.)



Shipment and Storage

(10) **CHAIN EACH CORNER TO TRUCK BED.**—When hauling by truck the tractor must be chained or wired down to prevent it from slipping off as the truck travels over rough terrain. In front, on each side, a chain can be passed through the front idler across the top of the track and secured to the side of the truck bed. At the rear, on each side, chains can be attached between the drawbar plate and the side of the truck bed.

(11) **PROTECT COOLING SYSTEM FROM FREEZING.**—Drain the cooling system or protect it with antifreeze solution as directed in paragraph 22.b.

(12) **DO NOT PLACE BLOCKS UNDER TRACTOR.**—Large blocks or solid objects placed under the tractor may get under the crankcase and break it as the engine springs up and down on the equalizer spring.

c. **Export Shipping.**—Refer to War Department Technical Bulletins TB 5-3124-1 and TB 5-3112-1 Preparation of Corps of Engineers Equipment for Export.

**103. LIMITED STORAGE.** (30 days or less.)

a. **General.**—If a tractor is to be stored or left standing for a long period of time, the following steps should be taken to prevent damage to the tractor, or trouble when the tractor is again placed into operation.

b. **Inspection And Repair.**—Carefully inspect and repair or replace any worn or defective parts that may cause damage to the machine during storage, or impair its efficiency.

c. **Cleaning And Painting.**

(1) **CLEAN THE MACHINE.**—If possible steam clean the entire machine.

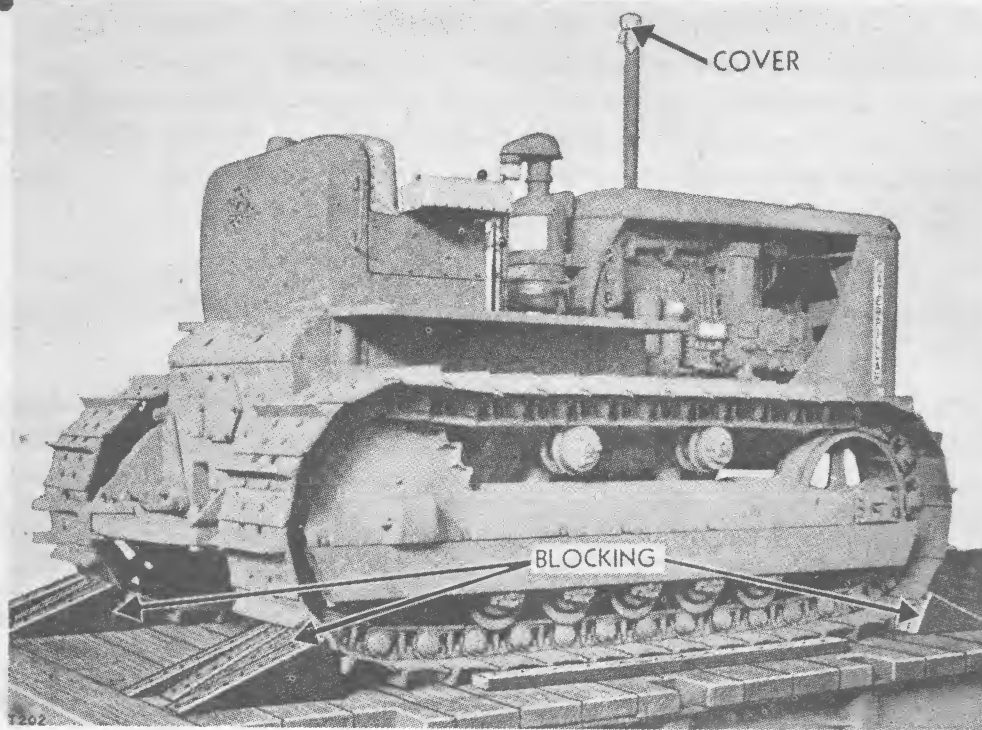
(2) **REMOVE MUD FROM TRACKS AND TRACK ROLLERS.**—To prevent the tractor from freezing fast, clean off all mud or dirt from the tracks and track roller frame, and place planks under both tracks.

(3) **PAINT ALL AREAS WHERE PAINT HAS DETERIORATED OR HAS BEEN REMOVED DURING CLEANING.**

d. **Complete Lubrication.**—Lubricate the entire tractor as outlined in paragraph 33.

e. **Prescribed Processing.**

(1) **DRAIN AND REFILL CRANKCASE.**—Most oil, when used in engines, becomes acidic in a short time, and will etch all polished parts it contacts if left standing for a long period of time. Drain the used oil and refill with fresh oil.



**Figure 108—Blocking Tractor On Flat Car**

(2) COMPARTMENTS.— Drain all normally dry compartments and replace the drain plugs. Replace any defective gaskets under compartment covers to prevent moisture from entering and make sure the covers are fastened securely.

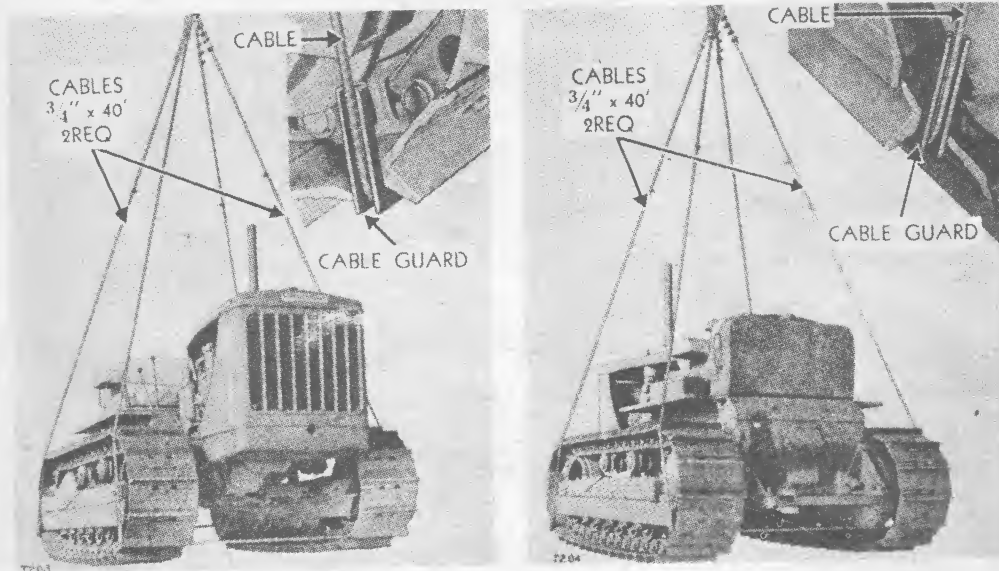
f. **Reference.**—War Department Army Regulations No. 850-18 Miscellaneous Storage of Motor Vehicle Equipment.

#### **104. DEAD STORAGE.** (Over 30 days.)

Refer to Technical Manual TM 5-9715 (latest revision), "Instructions For Preparation Of Corps Of Engineers Equipment For Storage."

#### **105. HOISTING THE TRACTOR.**

a. **General.**— If the tractor must be moved or loaded with a hoist or crane, the equipment necessary is at least a 12 ton hoist and two  $\frac{3}{4}$  in. wire cable slings 40 ft. long. If a great number of tractors are to be moved in this fashion, four hoisting cable guards will prevent the sharp edges of the track shoes from damaging the cable.



**Figure 109—Hoisting Tractor Using Slings**

**b. Procedure.**

- (1) PLACE THROTTLE CONTROL LEVER IN THE "SHUT-OFF" POSITION.
- (2) PLACE THE COMPRESSION RELEASE IN THE "RUN" POSITION.
- (3) SHIFT THE TRANSMISSION INTO "FIRST" SPEED.
- (4) ENGAGE THE FLYWHEEL CLUTCH.
- (5) LOCK THE BRAKE PEDAL IN THE "APPLIED" POSITION.
- (6) PLACE SLINGS UNDER THE TRACKS. (See figure 109.)—Place one sling under each track at the front and the other sling under each track at the rear of the tractor, in the angle between the grouser and the shoe of the first shoe angling up from the ground. As the cable tightens up, make sure the cable guards are in place.
- (7) RAISE THE TRACTOR WITH A HOIST OR CRANE.

## SECTION XXX

### REFERENCES

#### 106. AUXILIARY EQUIPMENT.

Equipment	T. M. Number
LeTourneau WCK7 Angledozer.....	TM5-1224
LeTourneau XD7 Bulldozer R7 P.C.U.....	TM5-1580
LaPlant Choate R71 Trailbuilder.....	TM5-1990
LaPlant Choate R76R Trailbuilder.....	TM5-1272
LaPlant Choate R76F Trailbuilder.....	TM5-1288
LeTourneau R7 Rear Power Control Unit.....	TM5-9282
LeTourneau FTD7 Front Power Control Unit.....	TM5-9372
Hyster D7N Winch.....	TM5-9150
Trackson MD7 Pipe Layer.....	TM5-1992
Trackson AF7 Angle Filler.....	TM5-1991

#### 107. PREPARATION FOR EXPORT SHIPPING.

Manual	Number
D7, With LeTourneau WCK7 Angledozer, FTD7 Front Power Control Unit and R7 Rear Power Control Unit.....	TB5-3070 (Latest Revision)
LeTourneau XD7 Bulldozer R7 Power Control Unit.....	TB5-3092 (Latest Revision)
Instructions for Preparation of Corps of Engineers Equipment for Export (General) .....	TM5-9711 (Latest Revision)
Preparation for Export Spare Parts for Corps of Engineers Equipment .....	TB5-9713 (Latest Revision)

#### 108. DEAD STORAGE.

Manual	Number
Instructions for Preparation of Corps of Engineers Equipment for Storage .....	TM5-9715 (Latest Revision)

#### 109. D7 TRACTOR REPAIR AND PARTS MANUALS.

Manual	Number
Repair Instructions .....	TM5-3068A
Parts Supply Catalogue.....	Eng. 9-3068